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VEHICLE HANDBOOK UPDATE 2026

SCIENCE FICTION ADVENTURE IN THE FAR FUTURE

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VEHICLE HANDBOOK UPDATE 2026

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INTRODUCTION

Vehicles are omnipresent in nearly every science fiction universe. They can range from rickshaws and canoes to grav tanks and even flying cities. The *Vehicle Handbook Update 2026* will allow you to use the same building blocks of vehicle types, features, customisations and options to create a continuum of vehicles ranging from the personal scooter to structures the size of cities.

A vehicle can be more than just a form of transportation. Whether a motorhome, a houseboat, a flying house or even an outhouse, the pieces to assemble vehicles are just as useful to assemble structures. The *Vehicle Handbook Update 2026* includes 'structure' as one type of vehicle and can be as simple as a shipping container or as complicated as an entire starport or city on the surface of a planet – or even free-flying, since even structures can include some forms of transportation. Whether you want to make a simple grav cycle or an armoured flying submarine, the rules in this book will allow you to design it. Because some vehicles require roads or rails or other infrastructure, this book also allows for construction of those as well and if you do not want to buy a vehicle off the lot, rules for manufacturing them are also included.

The *Vehicle Handbook Update 2026* allows for creation of things bigger than the *Robot Handbook* and smaller than *High Guard*, although it does not prevent you from sticking a robot brain in a vehicle and making that vehicle a giant walking (or flying, or both) robot, nor does it prevent you from making a vehicle bigger than the biggest starship. Still, the major premise is concerned with making things people can ride or inhabit and that generally stay near the surface of a world, even if that world is just a lump of asteroid. This book is designed to be compatible with those of *High Guard* on the big end and the *Robot Handbook* on the small end, and you can use elements from those books if there is a component you want to include in your vehicle.

Operating various vehicles can require a variety of skills and specialities. When a rule or option applies to the person in control of making the vehicle move, who can be a driver, flyer or seafarer, this book will use the generic term 'operator' rather than 'driver' or 'pilot' or 'sailor'. The *Traveller Core Rulebook* allows for specialities within a skill, and the granting of zero-level skills into other specialities within the skill also applies to vehicles, but the Referee may rule that an operator of a TL3 airship might be baffled by the controls of a grav vehicle or ornithopter and may impose a penalty, although it should never be worse than DM-2.

While the rules in this book are compatible with the *Traveller Core Rulebook*, certain vehicle-specific additional or altered rules are present. Most of these build directly from more general *Traveller Core Rulebook* rules but in some cases, they may vary to allow for more granular results. The New Rules chapter explains these rule additions but as with any *Traveller* campaign, the Referee is free to ignore or change those rules that do not fit the current adventure.

This update retains the system of Spaces from the previous version of the *Vehicle Handbook*. In most cases, the type of engine, mixture of fuel and specifics of transmission and locomotion need not be spelled out in detail, as there is only marginal value in making a gasoline, diesel, or battery-powered version of the same vehicle if they all have about the same performance. That does not mean you cannot make a vehicle faster or more agile or even more expensive than an 'identical' model, but it starts off with the assumption that a standard vehicle exists and that its structure, engine, fuel, transmission and locomotion uses about half of the volume occupied by the vehicle. There are exceptions, of course; a structure does not need most of these things and might receive its power from the grid and so has more Spaces available for components. On the other end of the spectrum, an airship is mostly filled with hot air or light gases (or at higher Tech Levels, the lightest substance of all: vacuum) and so has very few of its Spaces available for uses other than keeping it afloat.

For special cases, different power plants are available in the Customisation chapter. These take up more Spaces and often provide much better Range and include solar (at least during the day) and various types of fission or fusion power – often referred to in other sections with the shorthand of 'nuclear' power plants, but these are customisations to consider, not required components unless the vehicle wields spacecraft-grade components from the *Traveller Core Rulebook* or *High Guard*.

To help navigate the process, two vehicles are built as examples to illustrate step-by-step vehicle creation. Also, worksheets for both vehicle and weapon system design are included, along with a form to summarise the final product. An electronic worksheet will be made available for those who want to use a spreadsheet to aid vehicle creation but it is easily possible to design even complex vehicles by hand. Mostly you just have to count the number of Spaces you use for outfitting the vehicle and add up the Costs of the base vehicle and added pieces.

Finally, the book contains a catalogue of over 100 vehicles for use in *Traveller* universes.

VARYING TECHNOLOGIES

Many *Traveller* materials are set in the universe of Charted Space. The *Vehicle Handbook Update 2026* is not intended to be specific to Charted Space but it does make certain technology assumptions based on that universe. Among these are anti-gravity technology, Fusion+ power plants, biotechnology and a certain Tech Level maximum for most items.

The *Vehicle Handbook Update 2026* assumes grav vehicles are available at TL8 and supplant many other forms of transportation by TL10. In other universes, such as 2300AD, anti-gravity is not available at all and other vehicle types have broader applications at higher Tech Levels. For example, in Charted Space the aerodyne rotorcraft is a niche vehicle and airships are a historical oddity but in a universe without anti-gravity or one in which it is introduced at a higher Tech Level, those vehicles continue to have broad uses. For a particular universe, grav vehicles, grav plates, inertial compensators and lifters might be entirely absent as options or might require more advanced technology, perhaps only available at TL12 or higher.

Fusion+ is a technology specific to the Third Imperium timeframe of Charted Space. It is basically a form of nuclear fusion at room temperatures, aided by gravity and nuclear damping technology. It greatly extends the range of vehicles that use it as a power source and lets them be refuelled with simple water. This invention was critical in the early growth of the Third Imperium but would not have been available in earlier eras, unless independently invented in distant regions beyond Charted Space.

The Major Races of Charted Space do not consider biotechnology to be central to their civilisations, at least not in the form of biotech vehicles or large weapon systems. While some sophonts might focus on this sort of technology, a biotech vehicle is mostly a niche product considered as a curiosity. Other universes or even other species not prominent but present in Charted Space might consider biotech to be the default technology. In those cases, items would be available at earlier Tech Levels and much more prevalent. This book places biotech in its own chapter, signifying its niche status in Charted Space but for some universes it might be more mainstream and easier to obtain.

Many of the materials published for *Traveller* not only use Charted Space as a background but the 'Golden Era' of the early 1100s as a campaign focus. At that time, the Third Imperium had TL15 as a general maximum, with some TL16 items available in limited quantities and from certain highly advanced worlds. Much of Charted Space is limited to TL12–14. This book focuses on vehicles from the most primitive to very advanced but does not provide much guidance beyond TL15 and none beyond TL19. Other universes might have a lower maximum Tech Level, such as TL12 or less. The *Traveller* ruleset can even be used in a campaign set entirely on a lower tech World, where TL3 is considered magical and a catapult high technology.

NEW RULES

In the main, the *Vehicle Handbook Update 2026* uses the rules in the *Traveller Core Rulebook's* Vehicles chapter starting on page 136. Some of the rules in this book expand or change those rules and those changes are described in this chapter. The changes result in some variation from the vehicles presented in the *Traveller Core Rulebook* and the modified designs are included in the Vehicle Catalogue in this book.

It should be noted that many of the rules presented in this chapter are not intended to be used every time the Travellers get into a vehicle. Many are extremely situational and will only be used in certain adventures and others will more often be bypassed (or flat out ignored!) in preference to abstracting the results of the Travellers' actions. However, they remain here and available, ready for when the Referee and Travellers need a bit more detail to find out exactly what happened during an adventure.

RENTAL VEHICLES

Some vehicles, especially common civilian ones, might be available to rent. The base rental cost for a vehicle can vary widely, based on availability and risk. A starting point for a daily rate is 0.5% of the vehicle's Cost, or Cr5 per Cr1000 of its value, with a deposit of up to 1% of its value in more turbulent areas or if the Travellers are unable to pass a credit check. Discounts of 10–30% might be available for rental periods of one week or longer.

Surcharges in risky environments might be substantial and might not be refundable even if the vehicle returns in a pristine state. The renter is usually responsible for routine replenishment of fuel and other essentials (see Maintenance and Supply) and might be encouraged or required to pay a fee for 'insurance', which could amount to as much as the rental cost itself.

Discounted rentals of used vehicles might be available but these vehicles likely have one or more quirks (see page 14).

MAINTENANCE

All vehicles require routine maintenance and the occasional topping off of fuel and other essentials. This is part of general vehicle care, although all vehicles should spend at least a few hours in a well-equipped workshop each year for a full service and advanced military vehicles might require a great deal more attention.

These costs are assumed to be covered by a monthly maintenance cost equal to 0.5% of the total cost of the vehicle and will cover all essentials and refills except ammunition and other stated extra costs.

VEHICLE COMBAT

Vehicle combat is described in the *Traveller Core Rulebook*. Except as noted here, those combat rules still apply.

HITTING LARGE VEHICLES

In general, it is easier to hit a larger vehicle. Use the Target Size table to determine the DM to hit a vehicle.

Target Size

Vehicle Size	Spaces	DM
Small	1–3	+0
Light	4–19	+1
Heavy	20–99	+2
	100–199	+3
Huge	200–999	+4
	1,000–1,999	+5
Massive	2,000+	+6

DAMAGE

The *Traveller Core Rulebook* uses the Light Weapons damage rule. This rule is replaced by the following: A vehicle's armour has an extra amount of Protection equal to its TL for all attacks that:

- Do not achieve a Critical Hit
- Are not Destructive
- Do not have a non-stun Blast trait

For example, if Ralph fires a pistol (3D-3 damage) at a TL7 vehicle with Protection +3, then a regular hit will need to overcome a total of +3 (Protection) and +7 (TL), or a total of 10 points of armour before causing damage.

If Ralph's shot was a Critical Hit, then the vehicle only has its Protection +3. If instead Ralph tosses a fragmentation grenade (5D damage, Blast 9), because of the Blast trait the vehicle will only have Protection +3.

BATTERY FIRE

Battery fire allows multiple identical weapons to be fired at the same target with one attack roll. If a mount has linked weapons (see page 104), the mount as a whole is a single unit of the battery, keeping the bonus damage for being linked.

All weapon mounts in the battery must contain the same number of linked weapons to count as identical and all weapons in a battery must have the target in their firing arc.

Every four weapon mounts in a battery grant an additional DM+1 to attack rolls, to a maximum of DM+6.

Batteries

Weapons Mounts	DM
1–3	+0
4–7	+1
8–11	+2
12–15	+3
16–19	+4
20–23	+5
24+	+6

The weapons in a battery will fire using its worst fire control system. A weapons battery may use also a fire director (see page 104), so even a battery of less than four weapons has utility. Battery fire cannot make Called Shots.

If a battery successfully hits a target, damage is calculated as follows:

1. Roll damage for one weapon mount in the battery.
2. Subtract target's Protection.
3. Multiply the result by the Effect. Effect +0 causes normal weapon damage.

VEHICLE CRITICAL HITS

The vehicle Critical Hit and damage resolution procedures presented here replace those in the *Traveller Core Rulebook*.

Vehicles are not solid pieces of equipment that degrade until they fall apart. They have critical components and features that malfunction or break if damaged. Just punching holes in a vehicle might not damage enough components to cause it to stop moving or render it ineffective. This is represented by inflicting Critical Hits upon the vehicle rather than reducing a Hull score.

Critical Hits can occur in two ways, by Effect or by damage to structure. For any one attack, the highest Effect determines the Critical Hit Severity but the multiple of the damage to a vehicle's Structure is always tracked. The maximum Severity a Critical Hit can be is Severity 6. Severity is not cumulative on a location; each Critical Hit is treated in isolation.

EFFECT

A Critical Hit can be the result of a very good shot, as explained in the *Traveller Core Rulebook* and occurs when an attack achieves Effect 6+ and is able to penetrate armour to cause damage. The Severity of the Critical Hit is equal to the attack's Effect -5.

STRUCTURE

Vehicles have a Hull value based upon their size, type and certain features. A vehicle's Structure score is one-tenth of its Hull value, rounded up. A very small vehicle might only have Structure 1 or 2, while a massive battleship might have a Structure in the hundreds or thousands. High Severity Critical Hits might also reduce Structure.

When a vehicle is attacked, deduct any Protection from the damage result and compare the remaining damage to the vehicle's Structure. If the damage exceeds the Structure score, the vehicle takes a Critical Hit of Severity 1. If the damage is double the Structure, a Critical Hit of Severity 2 results, if it is tripled, the Critical Hit is Severity 3, and so on.

For example, after armour is accounted for, 48 points of damage is inflicted on a vehicle with Structure 10, resulting in a Critical Hit of Severity 4.

DAMAGE

Vehicle damage consists of the specific effects of Critical Hits to locations on the Critical Hits table and to the total number of times that an attack equals or exceeds the vehicle's Structure value. Keep track of the total number of times that damage exceeds a vehicle's Structure. Damage from any attack roll that is less than a vehicle's Structure value is superficial and has no effect on its performance during the encounter but might result in minor effects from the Quirks and Damage table on page 15. Even if total damage exceeds the Structure, any incremental damage is not tracked:

- **When damage exceeds a vehicle's Structure 10 times**, the vehicle is disabled and cannot move or use any remaining powered systems or equipment. Flying vehicles will fall, floating vehicles will sink and submarines will sink further. While specific circumstances may vary as determined by the Referee, by default, a vehicle will take 1D rounds to crash, sink, or reach crush depth.
- **If the damage exceeds a vehicle's Structure by a total of 20 times**, the vehicle has broken into pieces. In addition to any effects from a crash, submersion or explosion, each occupant suffers 1Dx1D damage, not alleviated by restraints or collision protection, but personal armour is applied.
- **If the damage to a vehicle exceeds its Structure a total of 40 times**, the vehicle and its contents are obliterated. A Referee may inflict 10D damage on each occupant in addition to any environmental effects.

LARGE VEHICLES

Big vehicles can absorb a great deal of damage. Damage from a single attack roll that exceeds a vehicle's Structure will always cause a Critical hit but a Critical Hit achieved by Effect is unlikely to completely disable a system:

- **Huge or Massive Vehicles of 200 Spaces** or more are only affected by Critical Hits caused by Destructive weapons.
- **Vehicles of more than 4,000 Spaces** are only affected by Critical Hits caused by spacecraft-scale bay-sized weapons or spinal mounts.
- **Vehicles of more than 20,000** Spaces are only affected by Critical Hits caused by spacecraft-scale medium and large bay-sized weapons or spinal mounts.
- **Vehicles of more than 200,000 Spaces** are only affected by Critical Hits caused by spacecraft-scale large bay-sized weapons or spinal mounts.

For example, after armour is accounted for, 39 points of damage is inflicted on a vehicle with Structure 10, resulting in a Critical Hit of Severity 3. The damage has exceeded the vehicle's Structure 3 times. If the vehicle is then hit by an attack that inflicts 72 points of damage after armour, it will suffer a Critical Hit of Severity 6, but the damage from the attack has exceeded its Structure by 7 times, and it is disabled since it has had its Structure exceeded a total of 10 times.

For simplicity, especially when dealing with many vehicles or with vehicles whose occupants' survival is not central to the adventure, any single attack causing enough damage to exceed Structure 20 times is assumed to have completely destroyed the vehicle, its occupants and any equipment or cargo carried aboard.

CRITICAL HIT RESOLUTION

For each Critical Hit, roll 2D for its location on the Critical Hit Severity table and apply the results of the corresponding Severity.

If a particular location does not apply to a vehicle, rather than rolling again, simply move one or more rows toward the centre of the table.

Speed: Once a vehicle's Speed Band is reduced to 0, it is incapable of independent movement.

An aeroplane reduced below Slow speed will not be able to fly, an STOL aeroplane can continue to fly at Very Slow speed but even a VTOL aeroplane when reduced to Idle will be unable to maintain flight.

In an atmosphere a vehicle no longer able to fly will descend at an increasing rate of one Speed Band per round, until reaching Very Fast speed or striking the ground. A pilot may attempt to control the descent of an aeroplane with a Difficult (10+) Flyer check (DEX) per round with a negative DM equal to the highest Speed Severity incurred.

On worlds without an atmosphere, falling vehicles will continue to accelerate until they hit the ground. The Referee can adjust the rate of acceleration on lower or higher gravity worlds.

Agility: If a vehicle's Agility is reduced to -10, its steering is disabled and it will continue in the same direction or carry on the same degree of turning as the previous round.

Fuel: Fuel loss is based on the vehicle's total Range. Once Range reaches 0 kilometres, the vehicle is out of fuel and cannot be further damaged by Critical Hits

CRITICAL HIT SEVERITY

		Severity		
2D	**Location**	**1**	**2**	**3**
2	**Speed**	Speed Band reduced by 1	Speed Band reduced by D3	Speed Band reduced by 1D
3	**Agility**	Agility reduced by -1	Agility reduced by -D3	Agility reduced by -1D
4	**Fuel**	Leak: Range is reduced by -2D%	Leak: Range is reduced by -1Dx10%	Leak: Range is reduced by -50% plus -10% per minute
5	**Power**	Speed Band reduced by 1, power reduced by -10%	Speed Band reduced by D3; power reduced by D3 x 10%	Speed Band reduced by 1D; power reduced by 1D x 10%
6	**Armour**	Armour on facing hit reduced by -1	Armour on facing hit reduced by -D3	Armour on facing hit reduced by -1D
7	**Hull**	Hull breached: compartment exposed	Hull breached: compartment exposed, roll another effect at Severity 1	Hull breached: compartment compromised, roll another effect at Severity D3
8	**Weapon**	Random weapon suffers DM-2 when used	Random weapon disabled	Random weapon destroyed
9	**Cargo**	10% of cargo damaged	10% of cargo destroyed	D3x10% of cargo destroyed
10	**Occupants**	Random occupant takes 1D damage	Random occupant takes 2D damage	D3 occupants take 2D damage
11	**Equipment**	Random equipment disabled	Random equipment destroyed	D3 Random equipment destroyed
12	**Operator**	Operator takes 1D damage	Operator takes 2D damage	Operator takes 3D damage

CRITICAL HIT SEVERITY

Severity		
4	5	6
Speed Band reduced 1D, Agility reduced by -1	Speed Band reduced to 0, roll another effect at Severity 1	Speed Band reduced to 0, roll another effect at Severity 1D
Steering disabled	Steering disabled: Speed Band reduced by 1	Steering disabled: Speed Band reduced by D3
Leak: Range is reduced by -50% plus -10% per round	Fuel explodes: roll another effect at Severity 1	Fuel explodes: roll another effect at Severity 1D
Power plant disabled: no vehicle power, Speed Band reduced to 0	Power plant destroyed	Power plant destroyed; roll another effect at Severity 1D
Armour on facing hit reduced by -2D	Armour on facing hit reduced to 0, roll another effect at Severity 1	Armour on facing hit reduced to 0, roll another effect at Severity 1D
Hull breached: compartment compromised, entire vehicle compromised in 1D hours roll, another effect at Severity 1D	Hull breached: compartment compromised, entire vehicle compromised in 1D minutes, roll another effect at Severity 1D, reduce the vehicle's Structure by half	Hull shattered: entire vehicle compromised in D3 minutes, roll 1D effects at Severity 1D, reduce the vehicle's Structure by half
Random weapon destroyed, roll another effect at Severity 1	Random weapon destroyed, roll another effect at Severity D3	Random weapon destroyed, roll another effect at Severity 1D
1Dx10% of cargo destroyed, roll another effect at Severity 1	1Dx10% of cargo destroyed, roll another effect at Severity D3	All cargo destroyed, roll another effect at Severity 1D
1D occupants take 2D damage	1D occupants take 3D damage	All occupants take 1Dx1D damage
1D Random equipment, roll another effect at Severity 1	1D Random equipment, roll another effect at Severity D3	All equipment destroyed, roll another effect at Severity 1D
Operator takes 4D damage, roll another effect at Severity 1	Operator takes 5D damage, roll another effect at Severity D3	Operator takes 6D damage, roll another effect at Severity 1D

to Fuel; these should be applied to Power instead. A vehicle with endurance instead of Range receives a reduction to its endurance, until it reaches zero and the vehicle is immobile.

Vehicles with Wind as a primary form of locomotion have Critical Hits applied to Speed or Power, whichever makes sense for the vehicle. Vehicles with Muscle for locomotion have Critical Hits applied to Speed, Power or even Occupants (or draft animals) as the Referee deems appropriate.

Power: An aeroplane whose loss of power brings it below its minimum Speed Band cannot stay aloft and is affected as noted in Speed. To keep the vehicle in a controlled glide requires an Average (8+) Flyer check instead and applies the worst Speed Severity, not the worst Power Severity as a negative DM.

Vehicles with Wind or Muscle as primary forms of locomotion or power apply the guidance given in Fuel.

Armour: Vehicles with Protection +0 will lose their TL armour adjustment once armour is reduced to 0. If this is the only armour the vehicle has, any Critical Hit will remove the TL armour adjustment on that face until repaired.

Hull: If the environment inside and outside the vehicle is the same, then this will have no additional effect. However, a hull breach that exposes a compartment to a hostile environment will be affected as the interior of the vehicle loses all environmental protection.

Most vehicles of less than 20 Spaces only have one compartment. Larger vehicles, if they have blueprints, might have compartments clearly marked. If not, each major component (cargo bay, passenger section, and so on) can be considered a separate compartment. If uncertain, most vehicles can be divided into one compartment per 100 Spaces.

An exposed compartment will allow the hostile environment to affect everything within, filling the compartment with poisonous atmosphere, water or emptying the atmosphere into vacuum within 1D minutes of exposure.

A compromised compartment will be fully affected within 1D rounds. This will result in a watercraft sinking, a submarine fully flooding and possibly imploding, or some other catastrophic effect. If multiple hits of the same Severity indicate an amount of time for a vehicle to be compromised, the remaining time is reduced to one quarter – so, for example, two minutes will become 30 seconds.

Reductions of the vehicle's Structure make it more susceptible to further damage-induced Critical Hits; round up the vehicle's adjusted Structure.

Weapon: Applies to one random weapon. If the same weapon receives a second Severity 1 effect, these are cumulative, so two Severity 1 Critical Hits result in a weapon suffering DM-4 to operate.

Cargo: This includes Spaces allocated to docking and hangar bays. Cargo damaged or destroyed is determined randomly. If the vehicle has specified ammunition storage, this is also considered part of Cargo, even if stored with its weapon.

If ammunition storage is destroyed, it causes damage to the vehicle. Exploding ammunition will cause 1D x ammunition Spaces × weapon damage to the vehicle.

Occupants: Damage from a Critical Hit to a random occupant is not prevented by the vehicle's armour or collision protection system but the occupant's own armour can be applied.

Equipment: Anything listed in the vehicle's equipment section has a chance of being damaged or destroyed. Once destroyed, it cannot be damaged or destroyed again and subsequent Critical Hits must be applied to different equipment. The Referee should determine the effect of damage on equipment – damaged equipment should inflict at least DM-2 to use. If some equipment is much larger than others, the Referee may decide to give it a greater chance of being damaged.

Operator: The operator of a vehicle is the driver/pilot/helmsman in control of the vehicle, or the robot/drone brain. On very large vehicles, this is the bridge or control centre of a vehicle and will affect a random occupant of that location. The operator can be protected from damage by personal armour but not that of the vehicle or its collision system.

CALLED SHOTS

An attack can target a particular component of a vehicle, such as the drive system or a weapon. A Called Shot must be direct fire (not artillery) and receives DM-2 to the attack roll. If the attack results in a Critical Hit, then the attacker can choose the location that has been hit on the Critical Hit Severity table.

For example, Ralph wants to shoot out the tyres of a fleeing vehicle and fires his laser rifle. Being an expert shot, he achieves an attack roll of 19, adjusted by DM-2 for a Called Shot to 17, a hit with Effect +9. The damage roll is 5D+3+the Effect (+9) for 28 points of damage. The vehicle has Protection +10 (TL Armour Protection is not counted for a Critical Hit), reducing damage to 18. The vehicle has Hull 50 and Structure of 5. Ralph's 18 points of damage exceeds Structure three times. The Structure threshold damage is recorded but only the Effect, which is higher, is used as the Severity of this Critical Hit.

Because it was a Called Shot, Ralph can specify that the Critical Hit result was Speed and, because of the Effect, this will be at Severity 4. The vehicle suffers a loss of 1D Speed Bands and Agility -1.

DAMAGE AND REPAIRS

If a vehicle suffers minor damage from an attack or collision which penetrates its armour, the effects of an encounter can cause lasting damage that is not noticeable until afterwards. For each encounter that causes minor damage, roll on the Quirks and Damage table (see page 15) with DM+1 to the first dice. However, the effects of Critical Hits represent severely damaged or destroyed components and sometimes actual structural damage.

To repair the effects of a Critical Hit requires an Average (8+) Mechanic check (1D hours x Severity, INT or EDU) and Cr500 multiplied by the vehicle's Structure and Severity of the Critical Hit. Repairs to restore a vehicle's Structure require a separate check and a further Cr1000 per point of Structure restored.

The Referee can allow the Mechanic check to reduce this cost by 10% per point of Effect but a failed check should consume 10% of this cost per point of negative Effect and leave the vehicle unrepaired.

Destroyed components cannot be repaired and their replacement is considered a retrofit and require 110% of the Cost of the original part, with a Difficult (10+) Mechanic check (2D hours, INT or EDU) to install it. The Effect will not result in discounts or cost increases.

COLLISIONS

A vehicle striking a solid object, such as another vehicle or a mountain, can sustain a great deal of damage.

The number of potential Critical Hits is equal to the vehicle's Speed Band on impact. Two vehicles travelling towards each other are treated as impacting at the sum of their Speed Bands. One vehicle running into another from behind is treated as impacting at the difference of their Speed Bands.

The Speed Band of impact is divided by two (rounding down) if the vehicle strikes a less solid object designed to absorb damage, like a crumple zone barrier.

LARGE VERSUS SMALL COLLISIONS

If one vehicle has at least twice as many Spaces as the other, damage to the smaller vehicle is still determined by the sum or difference of Speed Bands as above but damage to the larger vehicle is treated as if it were hit by a missile or other ranged weapon in a ramming attack.

The ramming vehicle inflicts 1D x the determined collision Speed Band + 1D for every full 50 Spaces of the ramming vehicle, plus the Effect of the attack.

If the collision is intentional, then it is rolled like an attack, with weapon skill replaced by the vehicle skill of the operator. If the larger vehicle can try to avoid the attack, the check is affected by dodging and evasive action. If the collision is unintentional, impact only occurs on an 8+, subject to dodging and evasive action.

Damage to the larger vehicle is treated like any other attack, with Critical Hit Severity determined as normal.

For example, a 100-Space vehicle (Structure 20, Protection +12) travelling at Medium (4) and a 25-Space vehicle travelling at Fast (6) collide head-on. The smaller vehicle will receive 4+6 = 10 potential Critical Hits.

In the case of an unintentional collision, 2D is rolled to determine whether an impact occurs, resulting in a 7. The DM is based only on the size of the larger vehicle, which for 100 Spaces is DM+3, adjusting the result to 10. This is Effect+2, which is a hit but not enough to cause a Critical Hit by Effect.

The damage inflicted on the larger vehicle is equal to the collision Speed Band (10) D plus 1D times the smaller vehicle's full 50-Space size, which here is zero, plus the Effect (+2) of the attack. If the 10D+2 roll was 37, then 25 damage would remain after deducting Protection. The 25 damage is greater than one multiple of its Structure (20), therefore the larger

vehicle would receive the effects of a single roll on the Critical Hit Severity Table at Severity 1 and record one attack exceeding its Structure.

COLLISION CRITICAL HIT SEVERITY

For vehicles striking other vehicles or structures of at least half their size in Spaces, roll 1D for each potential Critical Hit from a collision. This is the initial Severity of each. If any result is greater than the number of potential Critical Hits, then it is discarded.

In the previous example, the smaller vehicle receives 10 rolls and none can be discarded as any 1D roll would be less than 10. The larger vehicle has been 'attacked' and does not use this procedure at all.

The remaining dice determine the Severity of each Critical Hit, with DM+1 if the vehicle has a light hull, DM-1 if the vehicle has a reinforced hull and DM-1 if the vehicle has the AFV trait. Results of seven are treated as six and results of less than one are discarded.

For each remaining Critical Hit, roll 2D on the Critical Hits table to determine the location. Use the determined Severity and apply the effects.

OCCUPANT COLLISION DAMAGE

Each occupant of a vehicle involved in a collision will suffer 1D damage for each Critical Hit inflicted on that vehicle, for instance, 10D to each occupant of the smaller vehicle in the example. The larger vehicle in the example is not subject to occupant collision damage unless that is a result of the Critical Hit.

If the occupant is secured by a seatbelt or similar restraints, this damage is then divided by four, rounded down. Personal armour does not protect against collision damage but if the vehicle has a collision protection system (see page 79), the Protection provided by this system is applied (and also after reducing damage for being restrained).

In a collision involving an Open Frame vehicle, unsecured occupants are thrown 10 metres in a random direction for every Speed Band the vehicle is travelling. An additional 1D damage is taken for each point of combined or the difference in Speed Bands.

SENSORS AND DETECTION

Vehicles have access to a variety of systems to detect objects in their vicinity, from eyes and headlights to radar, lidar and densitometers.

The type of sensors a vehicle is equipped with will define their Range and any bonus to checks made to detect objects. These checks will use the Electronics (sensors) skill, although vehicles lacking even basic sensors will instead be reliant on a Traveller's Recon checks or hand-held sensors.

To detect an object within Range of a vehicle's sensors requires an Average (8+) Electronics (sensors) check (1D seconds, INT).

RANGE

Objects closer than the effective range of a sensor are easier to detect. If the object is within half this Range, gain DM+2 and if it is within a quarter of this Range, apply DM+4.

Beyond effective range, sensors might still be able to detect objects. If an object is within twice the sensor's Range, DM-2 is applied and within four times the range, DM-4. Beyond this, an object is not detectable.

When using the Recon skill, the assumed default Range is 1,000 metres.

SIZE

Larger vehicles are easier to detect. Use the DMs from the Target Size table on page 5 to determine the modifier.

HIDING

If the object is hidden from view, DM-2 is applied and the Referee may rule that the sensors are unable to detect it at all (in general, if there is no line of sight, sensors of TL7 or less will be useless).

At TL8 and above, sensors might be able to locate an object hidden by obstructions or even beyond the horizon if they can interpret reflective or shading data from other objects within sight. Such sensors can detect hidden objects at DM-4.

DETECTION FACTORS

Many factors can affect detection. Camouflage and stealth options can make detection increasingly difficult. Camouflage has a listed minimum range, inside of which it is ineffective.

When an object is obscured by camouflage or stealth, the Tech Level difference between the sensor and the obscured object affects the ability to detect it. For every Tech Level the sensor is greater than the Tech Level of the camouflage or stealth object, gain DM+1, up to a maximum DM provided by the camouflage or stealth option. If the camouflage or stealth is of greater Tech Level than the sensor, apply DM-1 for every TL the sensor is lower than the obscured object, to a maximum DM-6.

If a target with stealth has any weapons mounted on external hardpoints, it suffers an automatic -1 penalty to its stealth rating. If the weapons themselves are not stealth-coated, the target vehicle suffers an additional -1 for each Space occupied by a weapon. This DM can continue until it completely erases both a stealth DM and any technological stealth DM granted to the vehicle but will not continue to degrade past this point.

If a vehicle is using electronic countermeasures (ECM), it loses all DMs from stealth but gains DMs from the ECM system.

A vehicle that shuts down all power will benefit from a lower signature and inflict DM-2 to sensor checks but cannot use any equipment requiring power. If a vehicle is firing weapons with either a heat or acoustic signature (basically anything except bows, catapults and silenced small arms), it gives sensors attempting to detect it DM+2 during rounds in which it fires.

Finally, a vehicle running a transponder is subject to DM+6 to detection. In most civilised worlds, civilian and commercial vehicles equipped with any sort of transceiver will be required to broadcast a transponder signal. Any vehicle with an autopilot will likely have a transponder running to allow communications to local traffic control. It is usually illegal to disable or tamper with a transponder. Even military vehicles will use a transponder in peacetime or when not expecting trouble but they can obviously silence the signal in combat.

The Sensor Detection table lists various factors that affect an Average (8+) Electronics (sensors) check (INT). A detection check should be considered a Significant Action in a combat round.

Once a vehicle is detected, it will remain detected unless it has a stealth rating that provides a positive DM (its DM and any TL differential DM will affect a detecting sensor), or if it is operating ECM not overcome by a Tech Level advantage. In those cases, if the range between the detecting and detected vehicle increases to the point where the DM changes, for instance from under to over half the listed range of the sensor, then the detector must succeed in another check to maintain detection.

Recon skill checks are not normally affected by Tech Level of the camouflage and are not affected by Stealth at all. A Recon check using visual aids such as thermal, light amplification or PRIS binoculars can grant a Tech Level DM against camouflage.

Sensor Detection

Factor	DM	Example
TL difference*	+/- difference in TL	TL15 sensor gains DM+3 to detect TL12 vehicle. TL12 sensor suffers DM-3 to detect TL15 vehicle.
Target Stealth rating	- rating	A target with Stealth (improved) causes DM-2.
Sensor rating	+ rating	A Sensor (improved) grants DM+1.
High Fidelity sensor	+1	A sensor has the High-Fidelity modification.
Target using ECM	Negates Stealth	A target loses all DMs for stealth.
Target using ECM	- ECM rating	A target is using its ECM system.
Target has Reflec Armour	+1	Target is covered in shiny coating.
Target powered down	-2	A target has shut off its engine.
Target at half listed Range	+2	Target at 25–50km scanned by 100km Range sensor.
Target at quarter listed Range	+4	Target at 25 km or less scanned by 100 km Range sensor.
Target at up to twice listed Range	-2	Target at 100–200km scanned by 100km Range sensor.
Target at up to 4x listed Range	-4	Target at 200–400km scanned by 100km Range sensor.
Target is firing weapons	+2	In the round the target is using a weapon with an acoustic or energy signature.
Target has external hardpoint weapons	-1 Stealth rating	Single DM for any bombs, missiles or drones attached to the outside surface, even if they have stealth.
Target has non-stealth weapons mounted on hardpoints	-Spaces to Stealth rating	Maximum degradation of Stealth is equal to the vehicle's Stealth rating plus any Tech Level Stealth advantage it has.
Target has an operational transponder	+6	Any vehicle transmitting an identifier signal.
Target size	+Target's size DM	See Target Size table on page 5.
Target is not in Line of Sight	-4	At TL8 and above a sensor can indirectly detect a target.

* Maximum TL difference is DM±6. The Tech Level DM can apply to either stealth or ECM but not both in the same round.

USED VEHICLE QUIRKS

Buying second-hand vehicles is a time-honoured process and Travellers short of a few Credits might try their luck on the used market.

If a Traveller is looking for a specific type of vehicle, the Referee might require a Broker or Streetwise check to locate it, imposing negative DMs if the vehicle is beyond the ordinary.

A used vehicle will cost 1Dx10% less than a new one if the vehicle is legal to purchase. Paramilitary and flat-out military vehicles are unlikely to be legally available at all but at the lowest Law Level worlds and even there, prices might be inflated if there is low supply. See the *Central Supply Catalogue* Equipment Availability chapter to determine if such a vehicle is available and how much it might cost. Allow DM+1 or +2 to the availability roll if the Travellers are willing to buy a used vehicle.

However, cynical Travellers will well know that one can never be absolutely sure about a used vehicle. On any used vehicle roll at least once on the Quirks and Damage table with a DM-1 on the first dice. Roll an additional quirk for every 10% discount in the vehicle's Cost.

Item 01–16 cannot be fixed unless the Referee provides a remedy, which might require an adventure. For other items, if cost is not specified, they require half the effort and cost as a Severity 1 Critical Hit to resolve.

Quirks and Damage

D66	Quirks (DM-1 on first dice) and Damage (DM+1 on first dice)
01	**Concealed Compartment:** The vehicle has a concealed compartment somewhere within its hull, allowing items to be hidden. This compartment is no larger than 1D% of the vehicle's volume.
02	**Boy Racer:** The previous owner liked to… 'improve' his vehicles. Increase Speed by one Band but generate D3 more quirks.
03–06	**Upgraded Electronics:** Increase the version of one piece of equipment by one level or add new equipment that is no more than 10% the vehicle's value, two Tech Levels higher and which requires no Spaces.
11	**Jalopy:** The vehicle seems decidedly unsafe. Reduce its Hull by 1D × 10%.
12	**Poor Colour Choices:** The hue of all or part of the vehicle is very distinctive and not in a good way.
13	**Difficult to Modify:** Any new modification performed on the vehicle costs twice as much.
14	**What a Piece of Junk:** There is something about this vehicle's proportions or assembly that just does not seem right. When placed next to another, similar vehicle, it will look cheap, ugly, ridiculous or all three.
15	**Bad Luck:** The vehicle seems cursed – the Referee is free to impose a Bane on any important skill checks when using it.
16	**False Documentation:** The vehicle was either stolen or totalled at some point but its documentation was later forged. Whenever papers are checked, roll 1D. On a 6, the discrepancy is discovered.
21	**Slow Leak:** If pressurised, the vehicle's environment degrades at 1% per day or one day sooner for vehicles with Insidious environment protection. Unpressurised vehicles leak, either in the rain or in water.
22	**Gutless:** The vehicle's motive systems have seen better days. Reduce Speed by one Band.
23	**Sloppy Controls:** The control systems have far too much play in them. Apply DM-1 to any operator checks.
24	**Poor Fuel Economy:** The vehicle is nowhere near as efficient as when it was new. Range is reduced by 10%.
25	**Faulty Sensors:** Every time the vehicle's sensors are used, roll 1D. On 6, they impose DM-4 to the check.
26	**Faulty Latch:** When the vehicle turns at maximum speed or attempts an Agility-related manoeuvre at any speed, roll 1D. On 6+ an exterior door will pop open, potentially expelling an unsecure occupant. On an Open vehicle, one secured occupant becomes unsecured on a 6+.
31	**Control System Damage:** On any failed operator check, roll 1D. On a 6 the power system shuts down, losing all power for the round and requiring one restart in subsequent rounds with an Average (8+) Operator check (1 round, INT).
32	**Flickering Lights:** When changing Speed Bands, roll 1D. On a 3–5 the vehicle's lighting system dims for one round; on a 6 the lights turn off for one round.
33	**Cracked Window:** The forward viewscreen has a crack. If not repaired, roll 1D per day of use. On a 6+ the crack spreads and all operator checks, including autopilot and Recon checks, receive DM-1. If spread, roll 1D per day of use. On a 6+ the crack causes a leak equivalent to a Severity 1 Hull Critical Hit.
34	**Faulty Fire Control:** Weapons are prone to jams. On a Heavy Weapons (vehicle) check of a natural 2 or an Effect of -6 or worse, the affected weapon jams, requiring a successful full Average (8+) Heavy Weapons check (D1 rounds, minus Effect) to clear. If the vehicle has no weapons, roll again.
35	**What is That Smell?** The vehicle's interior smells disgusting and no amount of searching seems to pinpoint its source. Decrease the vehicle's Comfort Points by 10%.
36	**Rough Ride:** Bad suspension, loose seats or annoying rattling noises cause discomfort. Decrease the vehicle's Comfort Points by 10%.
41–46	**Minor Cosmetic Damage:** External scratches or dents require 1D x Cr100 or 1D x 2% of the vehicle Cost, whichever is less, to repair.
51–56	**No Effect.**
61–66	**Minor Damage:** Roll 1D to apply an issue from rolls 21–26. This condition can be repaired for 1D x Cr250 or 1D x 5% of the vehicle Cost, whichever is less.
71–76	**Equipment Glitch:** Any time a skill check is required for operating the vehicle or any of its equipment, roll 1D. On a 6, apply a bane is applied to the check. This problem requires a Difficult (10+) Mechanic (1D hours, INT) check to diagnose and 1D x Cr500 or 1D x 10% of the vehicle Cost, whichever is less, to fix.

VEHICLE TRAITS

A vehicle might have traits that affect its performance and capabilities. Some of these are inherent to the vehicle type or size, while others result from features added.

AFV: An Armoured Fighting Vehicle (AFV) is designed for combat conditions, using a reinforced frame and composite materials to support three times the maximum armour. An AFV also has 50% more Hull than a similarly sized vehicle but moves one Speed Band slower.

Only vehicles of Heavy or greater size can have the AFV trait. See the AFV feature on page 16 for further details.

ATV: A vehicle with this trait is an All-Terrain Vehicle. This vehicle is designed with rough ground in mind and can negotiate terrain inaccessible to other vehicles. A Walker has the ATV trait by default. See Terrain on page 20 for further details.

Off-Roader: A vehicle with the Off-Roader trait has its drive and suspension system modified to give it an improved ability to travel over unprepared surfaces such a brushland, low hills and muddy tracks. See Terrain on page 20 for further details.

Open Vehicle: An Open Vehicle is one in which the driver and passengers ride on the outside of the vehicle's structure. Examples include motorcycles, snowmobiles, personal watercraft, G/bikes and even some ultra-light aircraft. A rider on a vehicle with this trait gains no protection or cover from the vehicle but can shoot or otherwise attack in any direction.

Open vehicles designed to hold occupants are limited to Subsonic Speed in an atmosphere (although their maximum Speed Band can be higher) and are limited to Small size. An Open Vehicle can be equipped with options to protect against vacuum or hostile environments but such protection only extends to the vehicle, not its riders. Similarly, life support systems cannot be installed.

Open-Topped: An Open-Topped vehicle is like an air/raft, speedboat or jeep with no cover. As a result, it is lighter and cheaper. However, its top or dorsal face has no armour, and its sides only provide half cover to its riders. A rider can shoot or attack in any direction.

Vehicles with this trait can be of any size but are aerodynamically limited to Subsonic Speed in an atmosphere. As with Open Vehicles, environmental protections do not extend to riders and life support systems cannot be installed.

Responsive: This vehicle can change Speed Bands twice as fast as normal. See changing Speed Bands on page 17 for details. A vehicle cannot be doubly Responsive. If a vehicle is Unresponsive because of size or another feature, the Responsive trait can be applied to overcome any one condition causing the Unresponsive trait.

Tracked: A Tracked vehicle is designed to overcome the roughest terrain. See Terrain on page 20 for further details.

While a tracked vehicle normally has its Speed Band reduced by one, it is not further reduced if the vehicle also has the AFV trait.

Unresponsive: This vehicle takes longer to accelerate or decelerate. See changing Speed Bands on page 17 for details. This affects larger vehicles and locomotives or may be a design choice during vehicle creation. A vehicle cannot be doubly Unresponsive. A vehicle designer may apply the Responsive trait to overcome any one condition causing Unresponsive but if multiple conditions lead to the Unresponsive trait, the vehicle will remain Unresponsive.

VTOL: The Vertical Take-Off and Landing (VTOL) trait allows a flying vehicle to launch from a pad or clearing rather than a runway or other long open area. It is an innate trait of airships, grav vehicles and rotorcraft.

WEAPON TRAITS

The following weapon traits are used in this book. Artillery and One Use are from the *Central Supply Catalogue*. Accurate and Inaccurate are new to this book.

Accurate: This weapon is especially accurate, allowing a gunner to hit a target with greater precision either by superior workmanship or by allowing a beam or burst of fire to adjust to strike the target. Accurate weapons receive an extra DM+2 to attack rolls within their effective Range and an extra DM+1 at long and extreme Range.

Artillery: Artillery weapons shoot projectiles along a ballistic trajectory, allowing them to 'lob' shots at targets out of sight. When firing at a target that can be seen, Artillery weapons follow the usual rules for ranged attacks.

When attempting indirect fire at a target that cannot be physically seen, the attack suffers DM-2. In addition, if the precise location of the targets is not known (enemies are behind a wall or have ducked down into a trench, for example) the attack will land 1D metres in a random direction away from them for every 100 metres the target is from the attacker. Apply the Effect of the attack roll to this 1D roll, making the weapon less or more on target.

It is worth remembering that knowing where targets might be does not mean they need to be seen. The use of sensors, as described on page 59, provides a good indication where enemies are lurking, as can forward observers.

Inaccurate: This weapon is inaccurate, even at short ranges. While its theoretical Range might be much further, at Long Range (51–250 metres) this weapon is considered to be at its Extreme Range and suffers DM-4 to attack rolls. At Very Long Range (251–500) metres, it suffers DM-8 and at Distant Range and beyond (501+ metres) it suffers DM-12. Fitting a scope or fire control system will not increase accuracy and aiming only provides a positive DM when used by a stationary weapon against a stationary target.

One Use: This weapon is designed to be used just once, completely expending its energy or ammunition and is then rendered useless.

SPEED BANDS

Speed Bands are defined on page 136 of the *Traveller Core Handbook* and further detailed here.

The Rounds to Reach column on the Speed Bands table shows the cumulative number of rounds needed to reach each Speed Band from a stationary position. The Distance per Round column indicates the distance travelled during a combat round when moving in a straight line at the highest velocity in the Speed Band.

The first Speed Band listed for a vehicle is its maximum Speed Band. A vehicle usually has better performance at its cruising Speed Band, listed in parentheses and usually one slower. If a vehicle can operate at a certain Speed Band, it is not necessarily able to operate at the top Speed of its maximum Speed Band.

It takes time for a vehicle to change Speed Bands. To increase or decrease speed from Stopped (Speed Band 0) to Very Fast (Speed Band 7) requires one round per Speed Band. To increase beyond this point requires a full minute, or 10 rounds to increase a Speed Band, so it takes 10 more rounds to reach Subsonic, and so on. It also takes a full minute to decrease one Speed Band if travelling at Subsonic or faster.

The Responsive and Unresponsive traits allow some vehicles to change Speed Bands faster or slower. A Responsive vehicle can change Speed bands twice as quickly, able to increase or decrease two Speed Bands per round at Fast or below and requiring just 5 rounds to change Speed Bands when moving faster. An Unresponsive vehicle is the opposite. It needs 20 rounds to change Speed Bands depending upon velocity.

Speed Bands

Speed Band	Speed Band Number	Kilometres per Hour	Rounds to Reach	Distance per Round
Stopped	0	0	0	0
Idle	1	1–20	1	33
Very Slow	2	20–50	2	83
Slow	3	50–100	3	167
Medium	4	100–200	4	333
High	5	200–300	5	500
Fast	6	300–500	6	833
Very Fast	7	500–800	7	1,333
Subsonic	8	800–1,200	17	2,000
Supersonic	9	1,200–6,000	27	10,000
Hypersonic	10	6,000+	37	+
Orbital	11	Depends on world Size	+10 per Size	+

Rockets thrusters (see page 52) can be Responsive, burning fuel quicker to change Speed Bands – this does not change the amount of rocket Spaces required to change Speed Bands but will quicken acceleration or deceleration. Rockets cannot be Unresponsive and function properly for upward travel, except on worlds of Size 4 or less.

REACHING ORBIT

Vehicles capable of Orbital speed take time to get there. To increase from Hypersonic to Orbital takes one minute (10 rounds) times the Size of the planet. As an example, a rocket starting at Stopped (0) will use seven rounds to reach Very Fast (7), another 30 to reach Hypersonic (10) and for a Size 8 world, another 80 rounds, or 117 total, to reach Orbital. Very few vehicles can reach Orbital Speed. Vehicles with rocket thrusters (see page 52) expend fuel every round to increase speed but a rocket might require two or more stages to reach orbit. Rocket thruster fuel consumption per Speed Band is not affected by a vehicle's Responsive or Unresponsive traits.

Gravitic vehicles do not need to reach Orbital speed to leave a world's atmosphere. While a grav vehicle cannot climb in altitude at full speed, it can climb at one-quarter of its maximum speed and will leave most atmospheres behind once it reaches 100 kilometres.

RE-ENTRY

To slow down from Orbital speed requires the opposite; a number of minutes equal to the planet's Size to decrease to Hypersonic speed and then a further minute to reach Supersonic and so on. Orbital velocity is difficult to maintain inside a world's atmosphere unless the vehicle has heat shielding installed (see page 63). Without heat shielding, a vehicle cannot travel faster than Hypersonic speed until it has left at least the bulk of a world's atmosphere.

On a world with an atmosphere, slowing down from Orbital speed is possible using only atmospheric breaking but without heat shielding, a vehicle will take damage equal to its Structure and will receive a random Critical Hit of 1D Severity for every minute until it slows to Hypersonic speed. Armour will initially protect against this damage but Protection will degrade by one point every round, until damage burns through into the vehicle. The vehicle is assumed to use the facing with the most armour prior to the start of re-entry.

Rockets can be used to decrease the damage done by re-entry forces, with each round of thrust acting to reduce the speed by an increment of one round. Aircraft, rotorcraft and airships can only use rocket power to slow down when outside the atmosphere.

Grav vehicles will usually avoid re-entry damage by braking to a lower speed above the atmosphere.

AGILITY

A vehicle's Agility is an indication of how responsive it is to a driver's commands and how well it manoeuvres. A high-Agility vehicle can change direction quickly and react almost as an extension of the operator's body. A low Agility vehicle is ponderous, taking a long time to turn or responding slowly to control changes.

LOW AGILITY

A vehicle with low Agility is not automatically more difficult to manage, otherwise a large ship with Agility -6 would be almost impossible to sail even at the simplest level. Instead, it is ponderous and tasks take longer to complete, requiring an extra round for each point of negative Agility. Negative Agility is usually compensated for by either immense skill or, more likely, increasing the timeframe of the check so manoeuvres will take much longer.

For tasks with a fixed timeframe of one round, the operator can choose to take Agility as a negative DM to completion as usual or use one Minor Action per round to avoid one point of negative Agility, using up to three Minor Actions in a round to eliminate three negative Agility DMs. It is not possible to convert a negative Agility DM into a positive Agility DM by using more Minor Actions.

> *For example, Beth is in a vehicle with Agility -3. A task requiring 1D rounds will take 1D+3 rounds by default. Beth succeeds in her task check with a positive Effect +4 and rolls 4 for duration, modified to 7. She can choose to keep the positive Effect or apply up to 3 of her Effect to counteract the extra time needed to complete the task, reducing it back down to four rounds duration. If she had failed her roll, the entire 1D+3 duration would elapse before she could try again.*
>
> *As another example, in combat, Beth's movement manoeuvring trick (evasion or some other action) requires a task check. The time is not specified, so it is assumed to occur within that round. Instead of risking failure with DM-3, she uses three Minor Actions to completely use up her actions for the round to eliminate the -3, and next round she can make the task check without a penalty from Agility.*

TURNING

A high Agility vehicle can possibly turn around completely in a single round, even at high speed. A low Agility vehicle will turn ponderously, perhaps taking many rounds to complete a wide turn. The rate, or number of degrees a vehicle can turn in a round, is dependent on Agility. If using a hex or square grid system, this can be approximated to the nearest hex or square side or corner each turn.

The basic turn rate of a vehicle is 60° per round. This is the effective rate for vehicles with Agility +0. Beyond this, the numbers become better or worse, as indicated in the Turning table, which also provides a guide on how many rounds a vehicle takes to make a 180° turn.

Turning

Agility	Rate per round	Rounds to 180°
+6	360°	0.5
+5	300°	0.6
+4	240°	0.75
+3	180°	1
+2	120°	1.5
+1	90°	2
+0	60°	3
-1	45°	4
-2	36°	5
-3	30°	6
-4	25.7°	7
-5	22.5°	8
-6	20°	9

Turning Faster: To increase the turn rate, the operator can make a skill check. A successful Difficult (10+) operator check (DEX) enables the vehicle to turn at a rate one Agility level higher for that round. A successful Very Difficult (12+) check increases the turn rate by two levels and so on. These checks do not include the vehicle's Agility DM. Exceptional Failure might result in a loss of control or crash.

Optional Rule: Making rapid turns at high speed places excess G-force strain on the vehicle and its occupants. The amount of G-force experienced by a vehicle is equal to its Speed Band divided by the number of rounds it takes to make a 180° turn, halved if moving below Fast speed, doubled at Supersonic speed and quadrupled at Hypersonic. For a very agile supersonic vehicle, this might be disastrous, although nothing prevents a vehicle from turning slower than its maximum rate to avoid excessive G-forces. If present, inertial compensators negate G-forces up to their rating and any grav plating can counteract up to 2G if the manoeuvre can be performed with the orientation of the decks in the same plane as the turn. The effects of high G-forces on vehicle occupants is described in *High Guard* on pages 46–47.

Vehicles might not survive high-G manoeuvres. A vehicle can withstand up to TL×1.5 in G-forces, +1 if it has the Agile feature and +1 if it has the AFV trait. Grav plates, lifters and inertial compensators transfer rather than negate energy and neither aid nor hinder the external structural integrity of a vehicle. Beyond its G-threshold, the vehicle will suffer a number of Critical Hits equal to the amount by which it exceeded its G-limits each round it continues the high-G turn.

TERRAIN

The characteristics of the terrain a ground vehicle travels across affect its performance. For simplicity, these rules assume three types of terrain: Clear, Off-Road and Rough.

Clear: Terrain is considered Clear if it is a prepared road surface, a dry and flat track, short grass, or any similar solid and flat terrain that provides little resistance to the progress of the vehicle.

Off-Road: Off-Road terrain is any terrain that causes a regular vehicle to slow down or proceed with caution. This includes muddy ground, uneven plains, small brush, low hills or a light forest with enough distance between trees to allow a vehicle to pass with some manoeuvring. A standard wheeled ground vehicle can proceed across Off-Road terrain but at a penalty.

Rough: If the terrain is very uneven, with gullies, dense forest, boulder fields or steep hills, it is considered Rough. A perfectly flat marsh or swampland that would cause a vehicle to sink into muddy or otherwise soft ground would also be considered Rough, as would any crossing of water other than a shallow ford across a mostly flat riverbed. Standard wheeled ground vehicles cannot traverse Rough terrain.

Some terrain is impassible to most ground vehicles. This includes very steep slopes, very dense boulder fields and other obstacles. A Walker can cross some impassible terrain, especially if it is equipped the Multi-Legged Feature, has vehicle-sized manipulators and/or the Gecko Grip option.

TERRAIN TRAITS

Ground vehicles with the traits of Off-Road, ATV or Tracked are better able to traverse terrain. Without these traits more difficult terrain is either unpassable or imposes a negative DM to skill checks and reduces vehicle Agility and Speed Bands. The Terrain Effects table summarises these effects.

The penalties serve three purposes. They are DMs to checks and reductions of Agility and to Maximum and Cruising Speed Bands. Note that a vehicle operator check usually allows for both skill and Agility to modify the check and *both* of these are impacted by terrain effects.

A ground vehicle with Smart Wheels reduces all aspects of the negative effect by one but does not allow a vehicle without the proper terrain traits to traverse Rough terrain or allow any vehicle to gain the ability to traverse impassable terrain.

Local conditions, such as weather, flooding, mass animal activity or high gravity might impose additional negative modifiers.

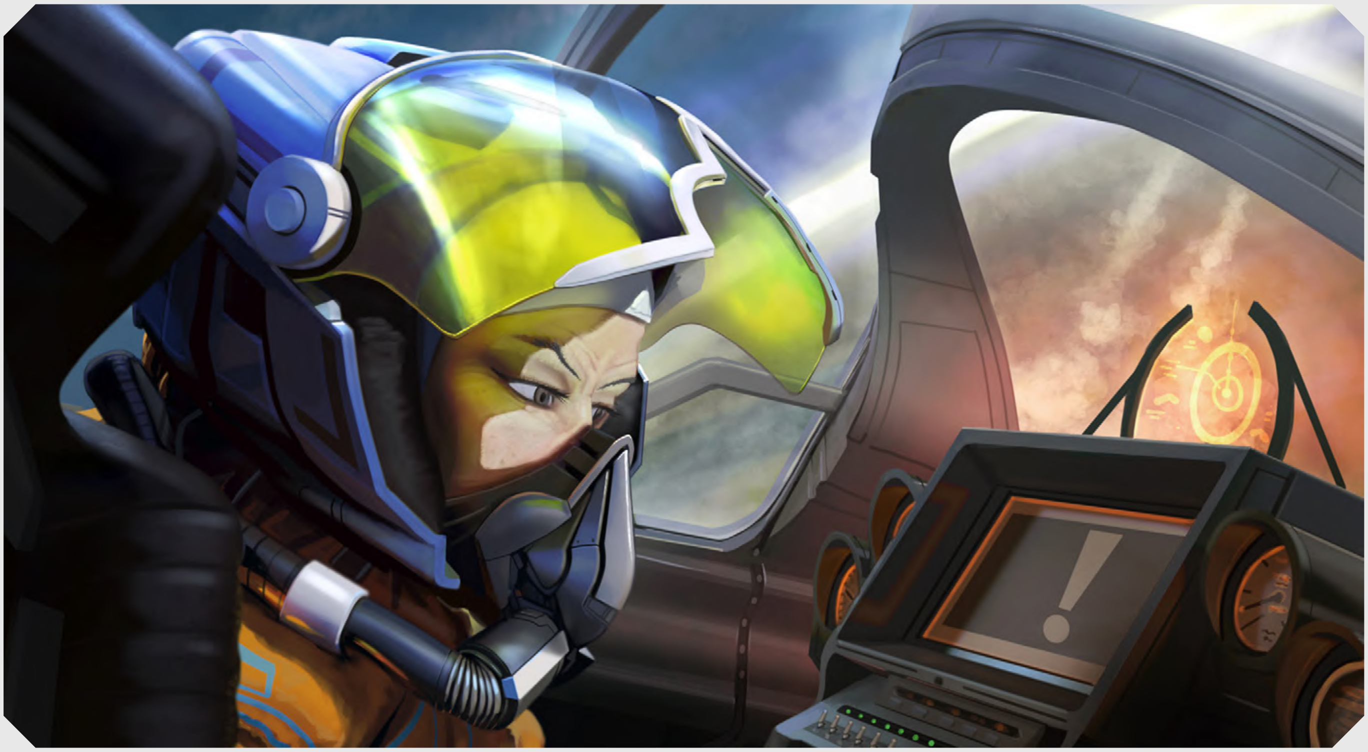
AIRBORNE MOVEMENT

Aircraft relying on aerodynamic lift or air-breathing engines – essentially any flying vehicle except grav vehicles – require an atmosphere to function and are designed for a specific atmosphere and gravity. They might function on other worlds but the further from their home conditions, the worse their performance becomes.

Terrain Effects

	Vehicle Traits			
Terrain Type	**None**	**Off-Road**	**ATV**	**Tracks**
Clear	No effect	No effect	No effect	No effect
Off Road	-2	No effect	No effect	No effect
Rough	Not allowed	-2	-1	No effect
Impassible	Not allowed	Not allowed	Not allowed*	Not allowed

* A Multi-legged Walker can cross some impassible terrain at DM-2 and a regular Walker might be able to cross some terrain impassible to other vehicles at DM-4.



ATMOSPHERE EFFECT

For atmospheric density purposes, Taint is ignored, so relevant atmospheric ranges for aircraft are Trace (Atmosphere 1), Very Thin (2 and 3), Thin (4 and 5), Standard (6 and 7), Dense (8 and 9) and Very Dense (D). An aircraft does not have a negative DM if operating on worlds with the same Atmosphere type. If operating in an adjacent Atmosphere type (so a vehicle built for Standard atmospheres could fly in Thin and Dense atmospheres), the aircraft can operate but with the following penalties:

- DM-1 to all Flyer checks.
- Agility -1
- Speed Band reduced by one
- Range reduced by 50%

Regular aeroplanes must be able to move at Slow speeds to achieve flight, although those with the STOL feature can fly at Very Slow speed and VTOL airplanes can hover or fly at any speed up to their adjusted maximum. Aeroplanes, airships and rotorcraft cannot fly in an Atmosphere type more than one step away from their homeworld's. For instance, an aircraft designed for a Standard (6–7) atmosphere cannot fly in Trace, Very Thin, or Very Dense atmospheres. If it is a regular aeroplane, it will still be unable to fly in an adjacent atmosphere if its adjusted maximum speed is not at least Slow and if it is Slow, the aeroplane must move at its adjusted maximum speed to maintain flight.

Atmospheres A, B, C and F do not necessarily have oxygen present – a requirement for most aircraft engines at TL8 or below – and can be of varying thickness, so aircraft designed for these atmospheres are usually specific to that world. Atmosphere E is a special case in that the world's surface pressure is either Trace or Very Thin but its atmosphere at very low altitudes such as canyons or rifts is Thin or possibly thicker.

SIZE

The Size of a world correlates heavily with a world's gravity. An aircraft is designed to achieve lift and power to overcome the gravity of a specific world. For each Size difference from that of its world of origin, greater or smaller, the aircraft inflicts DM-1 to all Flyer checks.

If the Size is greater than the Size of the world of origin, for each Size difference, the aircraft's Speed Bands are reduced by one and Range is reduced by 10%.

If the Size is at least one less than the world of origin, then Speed Bands are increased by one and Range is increased by 25%, regardless of the Size difference. However, this will not grant an aircraft Supersonic or Hypersonic speeds unless it had that ability on its homeworld.

COMBINED EFFECTS

Atmosphere and Size differences are additive in most cases. This can mean that Speed Band and Range effects may be moderated or eliminated by certain combinations of conditions but the skill DM imposed on the pilot is always negative. Also, the limitation of aircraft only being able to operate in the same or adjacent Atmosphere types is not overridden by any positive effects from a world Size reduction.

> *For example, an aeroplane designed for Terra (Size 8, Atmosphere 6) is moved to the nearby world of Prometheus (Size 7, Atmosphere 8). The aeroplane has an Atmosphere effect from moving from a Standard to a Dense atmosphere, resulting in DM-1 to skill checks, Agility -1, Speed reduction by one Speed Band and Range reduced by 50%. The Size Effect from moving from Size 8 to 7 results in another DM-1 to skill checks for the Size difference, the Speed Band is increased by one and the Range is increased by 25%. The combined effect is a DM-2 to skill checks, Agility reduced by one, Speed Band unchanged and Range 75% of normal (-50% + 25%).*
>
> *If the same aeroplane was moved to the world of Melchior (Size 5, Atmosphere 5),its Atmosphere effect from moving from Standard to Thin would also be DM-1 to skill checks, Agility -1, Speed reduction by one Speed Band and Range reduced by 50%. Its Size Effect would be a DM-3 to skill checks, an increase of one to its Speed Band, and a 25% increase in Range. This change would result in a combined DM-4 to skill checks, Agility -1, unchanged Speed Band and a Range 75% of normal. The further divergent from its world of origin the more difficult the aeroplane is to control. These negative DMs would also apply to any Autopilot.*

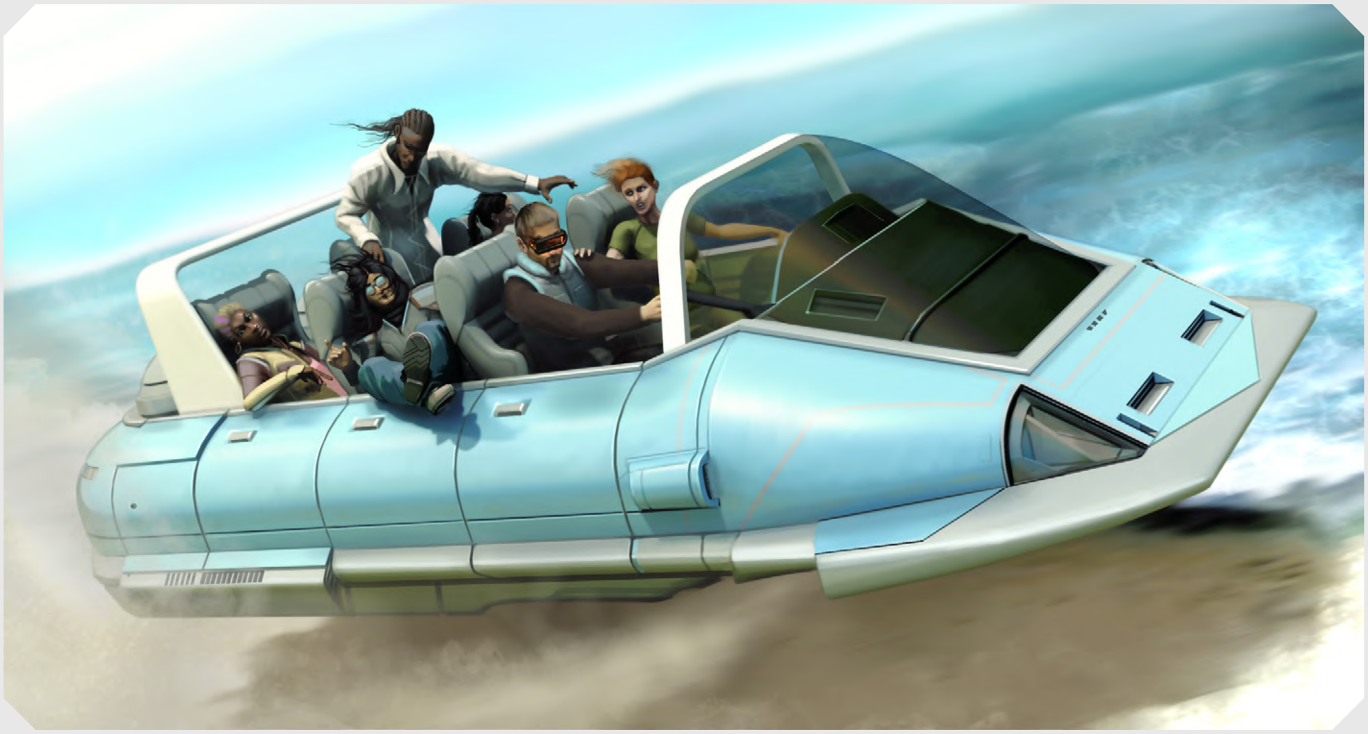
GRAV VEHICLES

Grav vehicles use a propulsion system that interacts with the world's local gravity field and are generally not powered by internal combustion engines or other engines reliant on an atmosphere to operate. A grav vehicle is limited in speed by power and by shape. Within an atmosphere denser than Trace, a grav vehicle that does not have the Streamlined feature is limited to Subsonic speeds but if it has the power to move faster, it can increase velocity outside an atmosphere to its maximum Speed Band.

A grav vehicle can reach orbital altitudes and is usually able to function up to 10 planetary diameters from a world. Once above the atmosphere, it can continue to increase speed to reach orbital velocity by a complex interaction of gravity, trading altitude for energy with a set of manoeuvres requiring 1D+(10-maximum Speed Band) hours.

CRUISING SPEED

The Speed Band of vehicles in *Traveller* is the maximum rate at which the vehicle can normally travel. Range will show the distance they can travel while at this maximum



speed. However, most vehicles will rarely travel at their maximum speed and will instead cruise to maintain a better balance of speed and endurance. The cruising speed of any vehicle is assumed to be one Speed Band lower than the vehicle's maximum and if it maintains an average of this rate of movement, its Range will increase by 50%. If a vehicle's maximum speed is Idle, then its cruising speed is also Idle but it retains the 50% increase in Range if it on average maintains an actual speed of less than half its maximum.

POWER ENDURANCE

If it is relevant, such as if using the vehicle's power to maintain life support or to power outside equipment, the number of hours a vehicle can operate is equal to its cruising Range divided by the lower limit of its cruising Speed Band. For example, a vehicle with Range 1,000 kilometres and High speed has a cruising Range of 1,500 kilometres at a cruising speed of Medium, which is 100–200 kilometres per hour. The lower range of Medium is 100 kilometres per hour, so it can operate for up to 1,500 ÷ 100, or 15 hours.

TOWING

Most vehicles are capable of towing heavy loads, usually a form of trailer or other vehicles. All checks using a vehicle's Agility suffer DM-2 while towing. Its Speed Band is reduced by one for every 50% of its Spaces (or 50% of its Spaces multiplied 250 kilograms) it is towing. A towed unpowered vehicle or a vehicle only equipped with grid power has its Spaces divided by two when computing towing capacity. The Locomotive feature (see page 38) will affect towing capacity, multiplying it by four.

For every decrease in Speed Band the amount of time required to accelerate from one Speed Band to another or to slow down is multiplied by that decreased number. This is in addition to an Unresponsive trait.

> *For example, a vehicle of 20 Spaces has a towing threshold of 10 if the towed vehicle is another powered vehicle. The towing vehicle suffers Agility -2 if it is towing any vehicle (powered or otherwise). A towed powered vehicle of up to 9 Spaces does not reduce the towing vehicle's Speed Band but a 10 Space vehicle reduces the Speed Band by one, but it does not cause an increase in the time it takes to change speed. If the towed vehicle is 20 Spaces, the towing vehicle will have its Speed Band reduced by two and will require twice as long to change speed – or three times as long as a 'regular' vehicle if the towing vehicle had the Unresponsive trait. At 30 Spaces towed, speed is reduced by three bands and changes to speed would take at least three times as long as normal.*

A vehicle towing another should have a coupler installed (see page 64), as should the towed vehicle but improvised latching and connections with anything from ropes and chains to magnetic connectors can link vehicles. A coupler or docking clamp allows power to be transferred between a towing and towed vehicle. If the towing vehicle has extra capacity in lifters, inertial dampers or grav plates, or any other item with a non-physical effect (such as a holographic hull or anything else the Referee deems acceptable), it can be applied to towed vehicles but only up to the number of Spaces of the towing vehicle itself. For example, if a 10 Space vehicle was towing a vehicle of 10 or fewer spaces, it could extend a lifter field to the secondary vehicle if it had the extra capacity, perhaps by installing lifters twice on the towing vehicle.

A vehicle being towed must have the ability to operate in the same environment as the towing vehicle and the Referee should use common sense when limiting possibilities. An aeroplane can tow a glider but would have trouble towing rotorcraft, for instance. Technically, an aeroplane could also tow a land or water vehicle, and a fast land or water vehicle could tow an aeroplane but again, the Referee should decide how practical such a situation would really be. Trains are a subset of towed vehicles and given the complexity of features and train tracks. Modifications to the speed of trains and other rail riders is detailed on page 182.

AIR LIFTING

Similar to towing, a VTOL vehicle can lift a load equal to its towing limit for a single Speed Band reduction into the air (whether or not there is an atmosphere), either secured by a cable or connector (for a grav vehicle, by lifting a load placed upon it). Multiple vehicles with similar towing or lifting capabilities can combine efforts to lift and move a larger object but all operator checks suffer DM-1 per additional vehicle involved in the operation, unless it is being coordinated with a Swarm Controller (see page 96).

Lifting and moving objects underwater is subject to the same rules and limitations as airlifting.

CREW AND PASSENGER COMFORT

By default, each crew or passenger seat uses one Space, assuming the vehicle is designed to human dimensions. Humanoid species ranging in size from Aslan to Vargr can also fit in a single Space seat. Smaller aliens can fit in this Space with booster seats or other aids. If a vehicle is designed for a sophont whose adult mass is less than 25 kilograms, two might fit comfortably in a single Space.

Larger aliens need large Spaces. As a rule of thumb, one Space is required for every 250 kilograms of mass, although physical dimensions and cultural differences might alter this considerably. For example, a Virushi requires four Spaces based on mass and would not be comfortable in vehicles with low ceilings or narrow aisles. A K'kree is technically lighter than a Virushi but is claustrophobic and requires five Spaces and an even taller ceiling.

Aquatic races require vehicles with the aquatic internal environment hull option (see page 62) to support the interior pressure. A Dolphin vehicle requires three Spaces per occupant, while one designed for an Orca requires 12 Spaces.

COMFORT LEVELS

A vehicle designed for short-term use can use less than the standard Space requirement but with a penalty. More or better spaces can positively affect the occupant's ability to function, as indicated in the Comfort Level table.

Certain items in the Option chapter's Creature Comforts section have a Comfort Point (CP) score, usually one per Space. Each standard seat Space has a Comfort Point of 1. Total Comfort Points, divided by the sophont's Space size and number of occupants is the total Comfort Level of the vehicle. If the Comfort Level number lies at the border of two levels, the better level applies.

If so desired, Comfort Levels can be tracked separately for different classes of occupants, with Comfort Points being allocated to Crew, Passengers, Residents or subdivisions of these categories separately.

DMs apply during occupancy of the vehicle and uncomfortable vehicles will have a negative effect on those who have been cooped up inside them. Exiting the vehicle will remove the negative DMs by one per combat round until the DMs are entirely removed but will not reset the DM timetable if the vehicle is then re-entered.

All Comfort Levels can be reset by two days rest 'off-duty' outside the confines of the vehicle or inside a vehicle with an Excellent or Luxury Comfort Level.

Comfort Level

Comfort Level	Comfort	Effect
Less than 0.5*	Intolerable	Immediate DM-2 to all tasks, plus DM-2 per 4 hours
Less than 1	Uncomfortable Seating	DM-1 after 4 hours, plus DM-1 per 4 hours
1–1.25	Basic Seating	DM-1 after 8 hours, plus DM-1 per 8 hours
1.25–1.5	Long Duration Seating	DM-1 after 24 hours, plus DM-1 per 24 hours
1.5–2	Extended Seating	DM-1 after 48 hours, plus DM-1 per 24 hours
2–4	Basic Comfort	DM-1 after 1 week, plus DM-1 per week†
4–8	Standard Comfort	DM-1 after 1 month, plus DM-1 per month†
8–24	Good Comfort	No negative effect
24–40	Excellent Comfort	No negative effect, recovery for Comfort Levels 2–8
40+	Luxury Comfort	For society's elites, recovery for Comfort Levels 2–8

* A lower limit for Comfort Level, sometimes referred to as 'Clown Seating' is usually about 0.25 but the Referee may impose different limits for emergency situations.
† Negative DM limited to DM-2.

VEHICLE DESIGN

There are uncountable variations of vehicle and vehicle-sized objects that can be defined using these rules but they can be categorised by a finite number of types and features, with customisation and options installed to make them unique.

SIZES AND SPACES

Vehicles come in all sizes, from a dirt bike to a rolling edifice the size of a city. The size of a vehicle is determined with Spaces.

SPACES

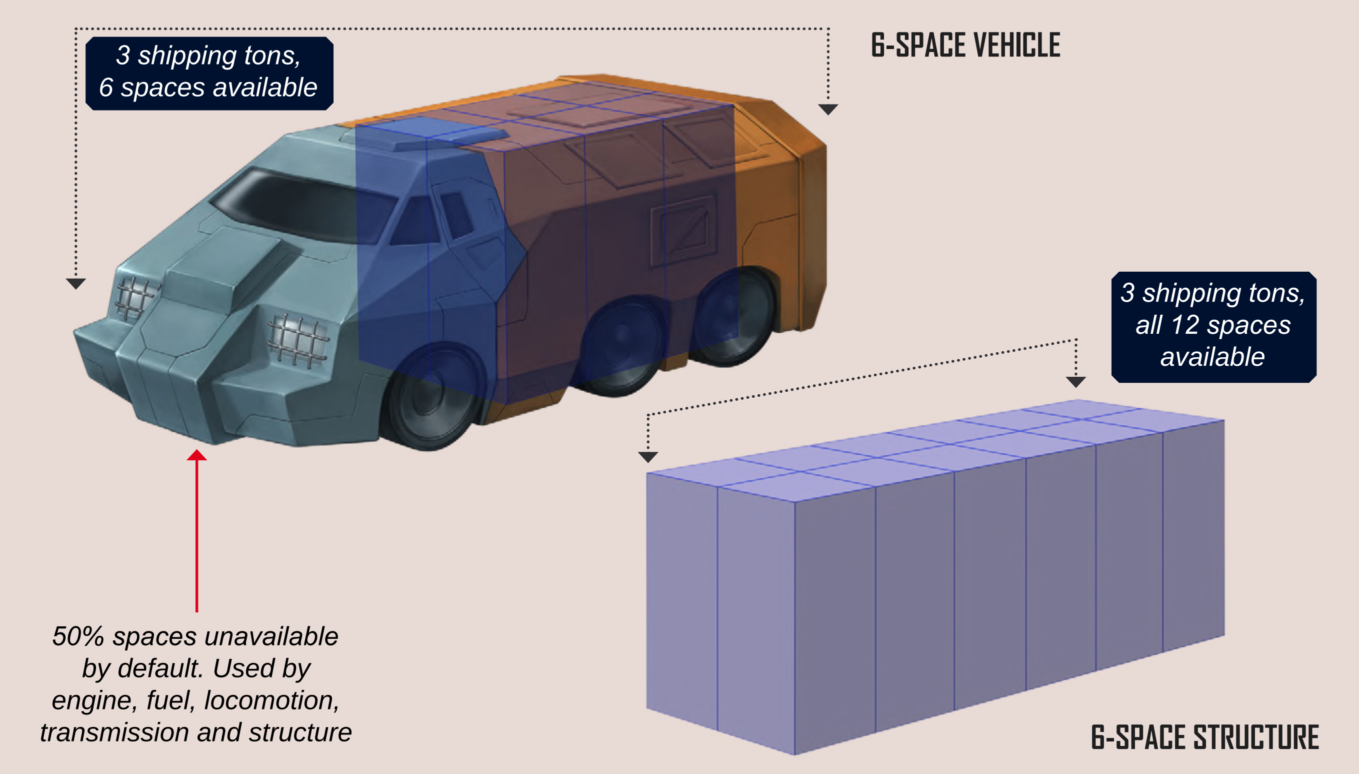
A Space is an abstract unit defining the size of the vehicle and what can be placed inside or upon it. Using Spaces defines a vehicle without necessarily worrying about calculations of spheres, cylinders and abstract shapes with wings or fins.

The baseline assumption for most vehicles is that their shipping tonnage (or half their total volume) is twice the volume of their available Spaces. Shipping tonnage is the equivalent spacecraft tonnage of a vehicle if it is being shipped as cargo or uses docking and hangar space or launch tubes and recovery decks.

Some vehicle types and various customisations can vary the volume available inside a vehicle. In the most extreme case, a box with nothing in it, a vehicle described as a one-Space vehicle can actually have two Spaces available for use inside. However, it will not fit two Spaces of itself inside itself in an infinite progression – there are rules for internal bays and shipping tonnage that prevent such things.

FRACTIONS

There are no fractional Spaces. Small items are either rounded up to consume one Space or ignored. Obviously, hundreds of small items are not ignored, so things such as a large ammunition bay consume a certain number of Spaces despite individual bullets being small. Mounted weapons of any type are always rounded up to consume one Space, although clustered or linked weapons on the same mount can be added together before rounding up.


3 shipping tons,
6 spaces available
6-SPACE VEHICLE
3 shipping tons,
all 12 spaces
available
50% spaces unavailable
by default. Used by
engine, fuel, locomotion,
transmission and structure
6-SPACE STRUCTURE

Vehicle Size

Size	Spaces	Speed Band Modifier*	Agility Modifier	Armour Volume	Traits	Exclusive Features
Small	1–3	+0	+0	x4	—	Open Frame
Light	4–19	+0	+0	x2	—	—
Heavy	20–199	-1	-1	x1	—	AFV, Locomotive, Tunneller
Huge	200–1,999	-1	-2	x0.5	Unresponsive	AFV, Locomotive, Tunneller
Massive	2,000+	-1	-4	x0.5	Unresponsive	AFV, Locomotive, Tunneller

* Aeroplane and Submersible Speed Bands are not affected by Size, nor is a fully crewed vehicle using Muscle or Wind power.

VOLUME

Just as spacecraft deck plans allow for variances based on the physical shape of a ship and varying ceiling heights, neither a displacement ton nor a Space is a precise measurement. For those wanting to compare a Space to an actual volume measurement, assume a Space 'averages' 3.5 cubic metres compared to a displacement ton of 'about' 14 cubic metres.

An object described in terms of spacecraft displacement tons consumes four Spaces per ton when installed in a vehicle.

A *Robot Handbook* item described in Slots can be installed in a vehicle Space at a rate of 64 Slots per Space. However, using items from the *Robot Handbook*, with the exception of robot-sized manipulator arms (see page 67) is not recommended and can lead to inconsistent results.

Unless otherwise specified, consider an item of 250 kilogram mass to consume one Space.

VEHICLE SIZES

Vehicle sizes affect baseline performance, traits and available features as indicated in the Vehicle Size table.

DESIGN LIMITS

Where possible, these rules are structured to produce reasonable results but in some cases hard limits need to be set.

COST

Certain features and modifications can lower the Cost per Space of a vehicle. However, the base Cost per Space for a vehicle cannot be less than one-tenth of its baseline Cost per Space. For example, regardless of how many features or customisations are added to an aeroplane with a baseline cost of Cr15000 per Space, the cost per Space of the aeroplane will always be at least Cr1500 per Space.

SPEED

Various features might allow a muscle-powered vehicle to achieve unrealistic Speed Bands. As a general rule, exceeding a maximum speed of Slow should be impossible for a muscle-powered vehicle and most would struggle to achieve even Very Slow speed for long. However, *Traveller* is a science fiction game and all manner of sophonts or beasts of burden might exist in a universe. While the Referee should normally limit at least the sustained cruising speed of these vehicles to Very Slow, this can be ignored in a situation where it is warranted.

Muscle- and wind-powered vehicle speeds are not negatively affected by their Size but instead by having too few rowers or sails to achieve their maximum speed. In general, any land or water vehicle can achieve Idle speed with at least some motive power being applied but the Referee can limit actual movement to just a few metres per round or a pace slower than walking, if it seems appropriate.

HULL

Regardless of customisation, a vehicle's Hull cannot be less than 1.

ROUNDING

When rounding to the nearest value, whether positive or negative, a remainder of exactly 0.5 always rounds up.

DESIGN OVERVIEW

This is an overview of the steps needed to create a vehicle. Not all steps are necessary, and they need not necessarily be done in this order, but the example vehicles in this book followed this process:

STEP 1 DEFINE THE PURPOSE

Decide what the vehicle is intended to do and how much it should cost.

STEP 2 DETERMINE TECH LEVEL

This is the default Tech Level of the vehicle and all its components and determines which types, features and options are available and how well the vehicle performs.

STEP 3 PICK VEHICLE TYPE

A type is based mostly on locomotion. Aeroplanes, airships, grav vehicles and rotorcraft fly, while ground vehicles and walkers operate on land. Watercraft travel over the water and submersibles underneath it. A hovercraft can travel over land and water. A structure is not a vehicle at all but can contain the same components as a vehicle. Each type has a baseline Cost per Space.

STEP 4 PICK SIZE IN SPACES

A usable Space is ¼ spacecraft ton. This is about half of the volume occupied by the vehicle, the rest is structure, locomotion, engine, fuel and 'elbow room'. Certain types and customisations may allow a similarly sized vehicle to have more Spaces available for the installation of components.

Spaces	Size	Examples
1–3	Small	Motorcycle, G/Bike, Snowmobile, Personal Watercraft
4–19	Light	Automobile, Light Truck
20–199	Heavy	Freight Hauler, Airliner
200–1,999	Huge	Jumbo Jet, Destroyer
2,000+	Massive	Battleship, Aircraft Carrier, Flying City

STEP 5 CHOOSE FEATURES

A feature is a specialisation of a type. Some features, such as Agile, can apply to almost any vehicle, others, such as Aerodyne, are specific to a particular type. A feature provides characteristics or modifies certain characteristics of a vehicle. This affects the vehicle's Cost per Space but rarely alters the amount of available Spaces.

STEP 6 CHOOSE CUSTOMISATIONS

Customisations are major modifications to vehicles, impacting power, speed, range and additional forms of locomotion. These affect Spaces, Costs and capabilities.

STEP 7 ARMOUR AND STRUCTURAL REINFORCEMENT

This determines the Protection the vehicle has on each of its six faces and its final Hull.

STEP 8 CHOOSE OPTIONS

The options of a vehicle are limited only by the vehicle's Tech Level, Size and imagination of the designer.

STEP 9 CHOOSE AUTOMATION

As technology progresses, more of a vehicle's systems can have computer-controlled automation to function. More than just an autopilot, these systems can allow for reduction or replacement of a vehicle's crew.

STEP 10 CHOOSE WEAPONS

Most vehicles are civilian but many are paramilitary or fully military in nature and have weapons systems ranging from simple gunports to sophisticated turrets with multiple weapons systems.

STEP 11 ALLOCATE OCCUPANT SPACES

Options can change the ability or requirement of a vehicle to support occupants. By default, these Spaces are 'free' in that they do not add to the cost of the vehicle. As a starting point, each occupant is assumed to require one Space.

STEP 12 ALLOCATE CARGO SPACE

One Space of cargo roughly corresponds to 250 kilograms of capacity and the fittings required to secure it. This volume is considered 'free' and included in the Cost per Space of the vehicle. A Space of cargo is the equivalent of ¼ displacement tons on a spacecraft.

STEP 13 FINALIZING

Traits and characteristics should be listed on a vehicle record sheet (a blank copy is provided in Appendix III, page 184). The designer might also wish to sketch out the shape of the vehicle and, for larger vehicles, develop a floor or deck plan indicating where crew and major components are located.

VEHICLE TYPES

There are 10 vehicle types, including structures. Each has certain general characteristics and can be further modified with features, as described in the Features chapter. Every type evolves as technology advances, gaining greater speed and longer range.

AEROPLANE

An aeroplane is a heavier-than-air vehicle that flies using aerodynamic lift created by fixed wings. Heavier-than-air flight is revolutionary in low and mid-tech societies, allowing fast access to regions separated by distance, rough terrain or water. Aircraft require lengthy landing strips, fields or bodies of water to take-off and land, unless equipped with features to reduce or eliminate the requirement.

Aircraft require an atmosphere to function and perform best in the environment for which they were designed (see Airborne Movement on page 20) to determine the effects of differing atmospheric pressure or gravity.

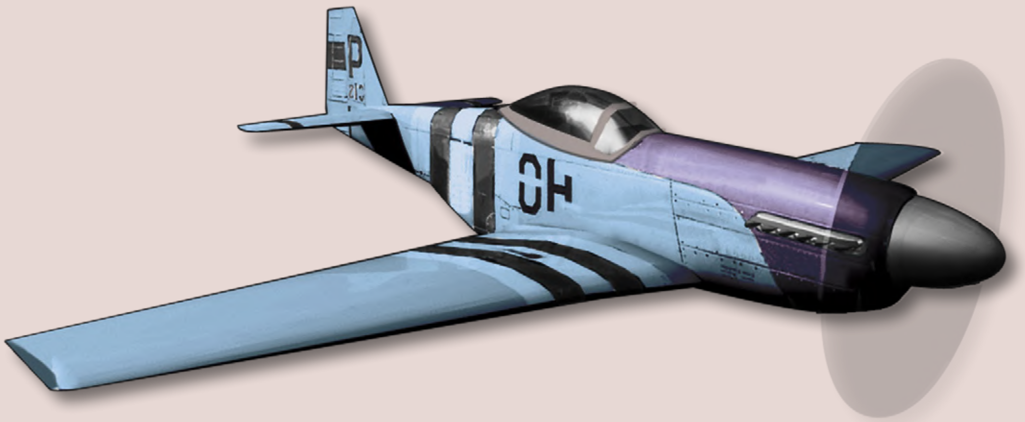
TL	Speed	Range
4	Medium	300
5–6	High	600
7–8	Fast	1,200
9–10	Very Fast	2,400
11+	Very Fast	4,800

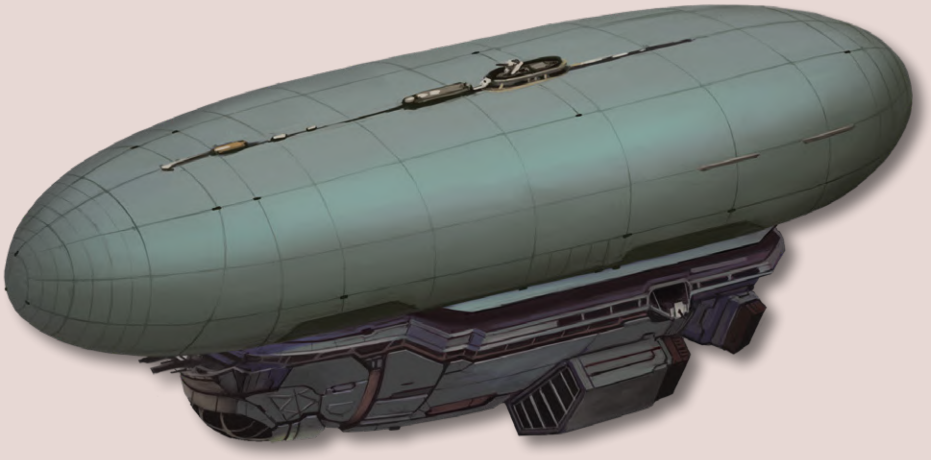
Features and Size may affect the maximum Speed Band of aeroplanes. If the combined modifiers for Size and one or more features reduces an aeroplane's Speed Band below Slow, it is unable to fly, even with STOL or Tilt Engine features. An aeroplane requires specific features to fly at Supersonic or Hypersonic speeds and can in some instances reach Orbital velocity.

TECH LEVEL	4
SKILL	Flyer (wing)
AGILITY	+1
HULL	0.5 per Space
SHIPPING	1 ton per Space
COST	Cr15000 per Space
EXAMPLES	Light aircraft, bomber, transport
ALLOWED FEATURES	Agile, Fast, Floats, Folding Wings, Hypersonic, Jet Engines, Open Frame, Open-Topped, Slow, STOL, Supersonic, Tilt Engines

RUNWAY LENGTH

An aeroplane that does not have the VTOL trait requires a runway to land or take off. Small and Light size aircraft typically require 2D × 100 metres to take off, while Heavy and larger aircraft require 4D × 100 metres. An STOL requires only half this length but an aircraft attempting to take off or land on a world with an atmosphere thinner than it was designed for doubles this length.





AIRSHIP

An airship is a lighter-than-air flying machine. Accordingly, it needs an atmosphere to operate and is subject to the same rules and limitations that affect aeroplanes when moving from one world to another as noted in Airborne Movement on page 20. Airships have no minimum speed limitations but if modifiers from Atmosphere, Size or features reduce the speed of an airship below Idle, then it does not have enough lift to take off. At TL4 and above, these airships are engine-powered by default but an unpowered version (a balloon) is still available.

Most airships are Heavy or larger. An airship can only use the small fraction of its Spaces listed in the Gas table for features or options; the rest are occupied by the gas envelope. The preferred safe gas used to produce lift is helium but either hot air or hydrogen can be used. An airship can choose to use hydrogen instead but any Critical Hit to its Hull or Fuel has a chance equal to the Severity rolled on 1D to start a catastrophic fire, resulting in at best a very rapid descent and one additional random Critical Hit per round.

An airship is non-rigid by default, like a balloon or blimp. As such, it can be greatly compressed by deflating its envelope for shipping. An airship with the Rigid feature such as a zeppelin, can have a greater range but cannot be compacted for storage or transport without full disassembly.

TECH LEVEL	3
SKILL	Flyer (airship)
AGILITY	-3
HULL	0.2 per Space
SHIPPING	0.1 tons per Space*
TRAITS	VTOL
COST	Cr300 per Space
EXAMPLES	Balloon, blimp, zeppelin
ALLOWED FEATURES	Agile, Fast, Open Frame, Rigid, Slow, Streamlined

* If disassembled, otherwise 0.5 tons per Space

TL	Speed	Range
3	Idle*	100*
4	Slow	4,000
5–7	Medium	6,000
8–9	Medium	8,000
10–11	Medium	1,2000
12+	Medium	18,000

* This airship must use Unpowered as its primary power and is an unpowered balloon whose speed, directionality, and range are dictated by atmospheric conditions.

Gas

Gas	TL	Available Spaces*	Range	Notes
Hot Air	3	1%	x1	
Helium	5	1.5%	x2	
Hydrogen	4	2%	x2	Hazardous†
Vacuum	12	2.5%	unlimited	Requires the Rigid feature

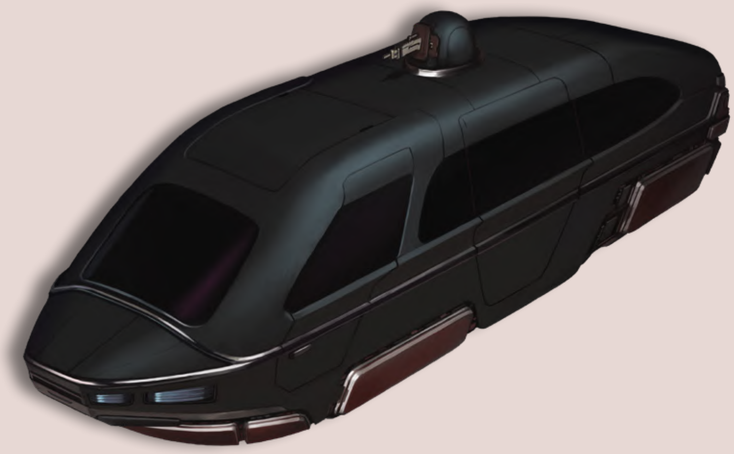
* Add 1% to available space figure for Streamlined airships. Round down available Spaces.
† See the text for risks of hydrogen gas.

GRAV VEHICLE

The advent of gravitic drives revolutionises air travel and eliminates the need for an atmosphere to provide lift. Using gravity against itself, a grav vehicle can travel up to 10 planetary diameters away from a world. Eliminating the complexities of supersonic engine airflow, a grav vehicle with the Streamlined feature can exceed Subsonic speeds in any atmosphere, provided it does not have the Open-Topped or Open Frame features, and even these vehicles can achieve arbitrarily fast speeds in a vacuum.

TECH LEVEL	8
SKILL	Flyer (grav)
AGILITY	+1
HULL	2 per Space
SHIPPING	0.5 tons per Space
TRAITS	VTOL
COST	Cr30000 per Space
EXAMPLES	G/bike, air/raft, G/carrier
ALLOWED FEATURES	AFV, Agile, Fast, Open Frame, Open-Topped, Slow, Streamlined

TL	Speed	Range
8	High	1,000
9–10	Fast	2,000
11–12	Fast	3,000
13–14	Very Fast	4,000
15+	Very Fast	5,000

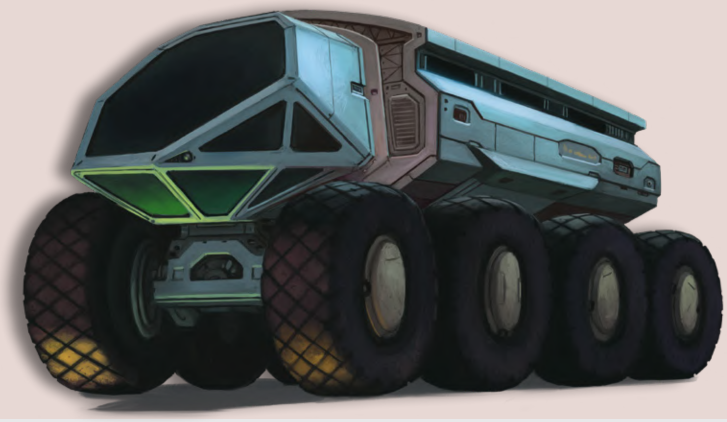


GROUND VEHICLE

A ground vehicle is restricted to moving across a solid surface using wheels, tracks or rails. The default configuration is a powered four-wheeled layout but size and features can alter this. A Streamlined ground vehicle can exceed Subsonic speeds with the same restrictions as a grav vehicle.

TECH LEVEL	1
SKILL	Drive (varies)
AGILITY	+0
HULL	2 per Space
SHIPPING	0.5 tons per Space
COST	Cr750 per Space
EXAMPLES	Motorcycle, automobile, truck, tank
ALLOWED FEATURES	AFV, Agile, ATV, Fast, Monowheel, Off-Roader, Open Frame, Open-Topped, Rail Rider, Slow, Smart Wheels, Streamlined, Tracks, Tunneller

TL	Speed	Range
1–2	Idle	—
3	Idle	50
4	Very Slow	100
5–6	Slow	300
7–8	Medium	500
9–10	High	800
11+	Fast	1,000



HOVERCRAFT

A hovercraft travels on a cushion of air and can traverse flat ground and water surfaces with equal ease. A hovercraft's performance is affected by changes to atmosphere and gravity, as noted in Airborne Movement on page 20, and cannot travel beyond Subsonic speeds under any circumstances but can continue to function even if restricted to Idle speeds. Hovercraft can travel over marshy, muddy ground without penalty but are not considered Off-Roaders when it comes to uneven terrain and cannot use features to overcome these limitations.

TECH LEVEL	5
SKILL	Drive (hovercraft)
AGILITY	+1
HULL	0.5 per Space
SHIPPING	0.5 tons per Space
TRAITS	none
COST	Cr10000 per Space
EXAMPLES	Hover jeep, landing craft, ferry
ALLOWED FEATURES	Agile, Fast, Open Frame, Open-Topped, Slow

TL	Speed	Range
5	Slow	300
6–7	Medium	400
8–9	High	500
10–11	High	600
12+	Fast	800

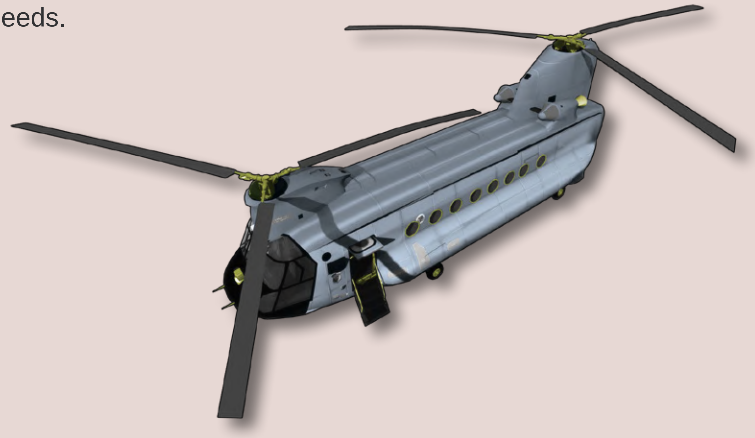
ROTORCRAFT

A rotorcraft is an aircraft that uses a rotating or otherwise moving surface to generate lift and thrust. The default configuration is a helicopter but aerodynes and ornithopters are also considered within this type. A feature of all rotorcrafts is their ability to perform vertical take-off and landing (VTOL), allowing them to fly and land from a small landing pad rather than requiring a runway. An aerodyne uses vectored jet engines to provide lift and thrust but unlike Tilt Engine aeroplanes, does not rely on wings. Rotorcraft are affected by changes to atmosphere and gravity as noted in Airborne Movement on page 20 but they can continue to function even if restricted to Idle speed. Only Streamlined aerodynes can exceed Subsonic speeds.

TECH LEVEL	5
SKILL	Flyer (rotor)*
AGILITY	+0
HULL	0.5 per Space
SHIPPING	1 ton per Space
TRAITS	VTOL
COST	Cr25000 per Space
EXAMPLES	Helicopter, aerodyne, ornithopter
ALLOWED FEATURES	Aerodyne, Agile, Fast, Floats, Folding Wings, Open Frame, Open-Topped, Ornithopter*, Slow, Streamlined

* For ornithopters, a pilot uses Flyer (ornithopter) to pilot this vehicle

TL	Speed	Range
5–6	Medium	500
7	High	1,000
8–10	High	2,000
11+	Fast	4,000



STRUCTURE

A structure is not a vehicle but other than the lack of primary locomotion and power, the processes used in the *Vehicle Handbook* allow for the building of structures just as easily and often more simply than vehicles. By default, a structure has a roof, four walls and a floor, with doors and windows as appropriate. It is stationary but may install auxiliary drive customisations (see page 50) to allow it to move. A structure might have certain features; an armoured bunker can be considered an Armoured Fighting Vehicle in terms of armour limits, while a Streamlined structure can be the basis of a rocket stage, if it chooses rocket as a secondary locomotion type.

Since a structure does not need internal power and locomotion systems, nor transmission and fuel storage, a structure has twice as many Spaces available for allocation as other vehicles. A structure defined as a 100 Space 'vehicle' would be able to utilise 200 Spaces for internal components but options applied to the structure, such as external environmental protection, have a Cost based on its defined size of 100 Spaces.

A structure is equipped with an internal power distribution system appropriate for its Tech Level and can have external grid power as its primary power source at no Cost or Space allocation. If a structure chooses to be internally powered, this consumes 25% of its *original* Spaces. In the case of a 100 Space structure with a default 200 Spaces available to be allocated, a powered structure would consume 25 Spaces, leaving 175 Spaces for other purposes. The powered option doubles the Cost per Space of the structure and provides independent power for up to one week.

TECH LEVEL	0
SKILL	n/a
AGILITY	-6*
HULL	1 per Space
SHIPPING	0.5 tons per Space
COST	Cr50 per Space
EXAMPLES	House, fortress, outpost, rocket stage
ALLOWED FEATURES	AFV, Open Frame, Open-Topped, Streamlined.

* Only applicable if the structure has some form of auxiliary locomotion.

TL	Speed	Range
0+	Stopped	0

SUBMERSIBLE

A submersible is a vehicle designed to travel under water or some other liquid. A Fusion+ powered submersible can continually refuel from water intakes that feed the power plant; this might not apply in exotic environments where the submersible is travelling through liquids that do not have a hydrogen component.

A submersible designed for use in water will not necessarily function properly in an ocean of ammonia or methane and is even less likely to function in more exotic environments such as hydrochloric acid, liquid nitrogen or magma. Any submersible designed for exotic environments must apply corrosive or insidious environment options and these tend to be specific to a particular liquid. Submersibles have a Safe Depth (the depth to which they can usually dive) and a Crush Depth (the depth to which they can go before being automatically destroyed).

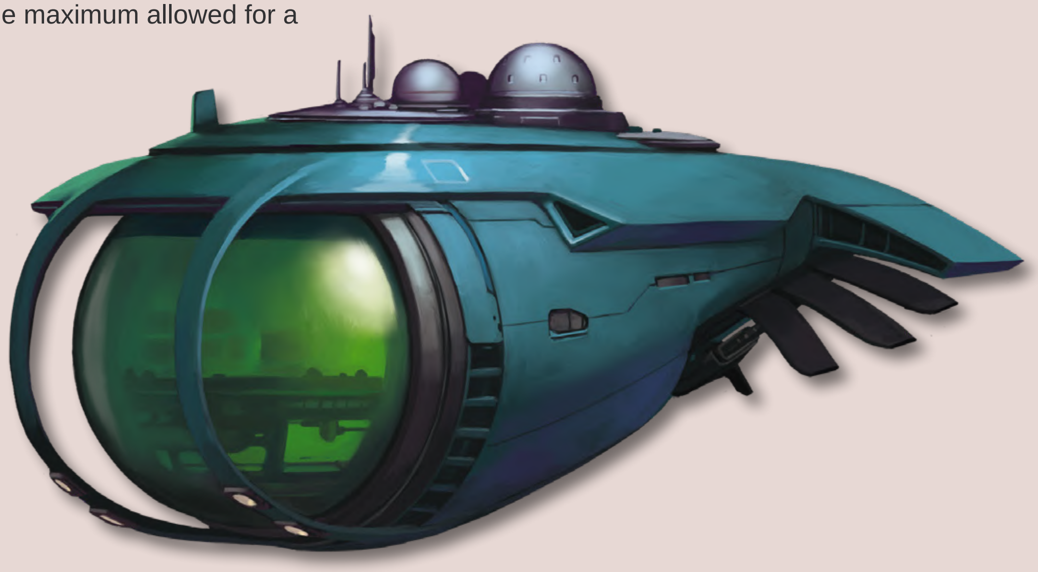
All submersibles have the hostile environment protection option and must choose a life support option (see page 80) to determine how long they may remain submerged. A submersible without life support installed can only remain submerged for a number of hours equal to half its Tech Level, rounded down.

TECH LEVEL	4
SKILL	Seafarer (submarine)
AGILITY	-2
HULL	3 per Space
SHIPPING	0.5 tons per Space
COST	Cr50000 per Space
EXAMPLES	Submarine, diving bell
ALLOWED FEATURES	AFV, Agile, Fast, Open Frame, Open-Topped, Slow, Tunneller

TL	Speed*	Range*	Safe Depth	Crush Depth
4	Idle	50	50m	150m
5	Very Slow	100	200m	600m
6–8	Slow	150	300m	900m
9–1	Slow	200	600m	1,800m
12–14	Medium	300	2,000m	6,000m
15+	High	500	4,000m	12,000m

* For conventionally powered subs with 20 or more Spaces, surface speed is one band faster with x20 Range. For nuclear-powered subs, speed is one band faster. Submersible speed is not affected by Size.

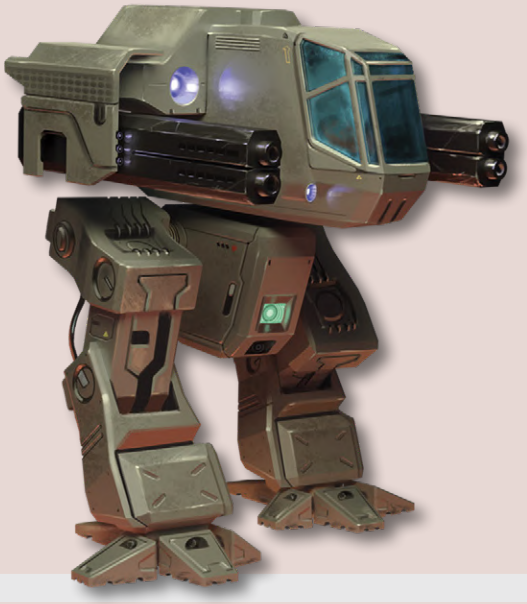
For every 100% increase in Cost per Space, a submersible's Safe and Crush Depths are increased by 100% and its base Protection by +1. This can be done multiple times but the submersible's base armour cannot increase beyond the maximum allowed for a vehicle of its Tech Level.



WALKER

A walker is a vehicle that uses computer-controlled legs to traverse the ground. Even the smallest is larger than a powered armour suit and walkers requiring greater stability might have more than two legs, with additional computing power that converts the operator's actions into a coordinated gait.

TECH LEVEL	8
SKILL	Drive (walker)
AGILITY	+0
HULL	2 per Space
SHIPPING	0.5 tons per Space
TRAITS	ATV
COST	Cr10000 per Space
EXAMPLES	Load lifter, AT-AT
ALLOWED FEATURES	AFV, Agile, Fast, Multi-Legged, Open Frame, Open-Topped, Slow, Tunneller



TL	Speed	Range
8	Very Slow	150
9–10	Slow	300
11–12	Medium	450
13–14	High	600
15+	High	750

WATERCRAFT

Watercraft are vehicles that travel across the surface of a body of water or other liquid, covering everything from a canoe to a cruise ship or aircraft carrier. At higher Tech Levels, in any environment where the liquid traversed has a hydrogen component, a Fusion+ powered-watercraft is assumed to be able to continually refuel from water intakes feeding the power plant. Larger vessels have considerably greater range than small or light watercraft.

TECH LEVEL	0
SKILL	Seafarer (varies)
AGILITY	-2
HULL	2 per Space
SHIPPING	0.5 tons per Space
COST	Cr2000 per Space
EXAMPLES	Canoe, speedboat, sailboat, tanker
ALLOWED FEATURES	AFV, Agile, Fast, Floats, Hydrofoil, Open Frame, Open-Topped, Slow

TL	Speed	Range*
0–2	Idle	0
3	Idle	100
4	Very Slow	200
5	Very Slow	400
6–7	Slow	600
8–11	Slow	800
12+	Medium	1,200

* Range for watercraft of 20+ Spaces is x10 the listed Range.

FEATURES

Features are modifications to a vehicle to make it suited to a particular purpose. Some features, such as Agile, Fast or Slow, apply to all vehicle types (except structures), while others, such as AFV or Floats apply to just a few types and certain features such as STOL and Tracked are unique to a particular type of vehicle. The Features Available table shows which are available to each type of vehicle. Other factors, such as the vehicle's Size and prerequisite or incompatible features might further limit the availability of a feature.

MULTIPLE FEATURES

A vehicle can have multiple features and these are additive in effect and price, based on the initial characteristics of the vehicle. For example, a vehicle with the Agile, Fast and Streamlined features would have Agility +2 (from Agile and Streamlined), +2 added to its Speed Band (from Fast and Streamlined), halved Range (from Fast) and be five times, or +400% its base Cost (+100% from Agile, +100 from Fast and +200% from Streamlined).

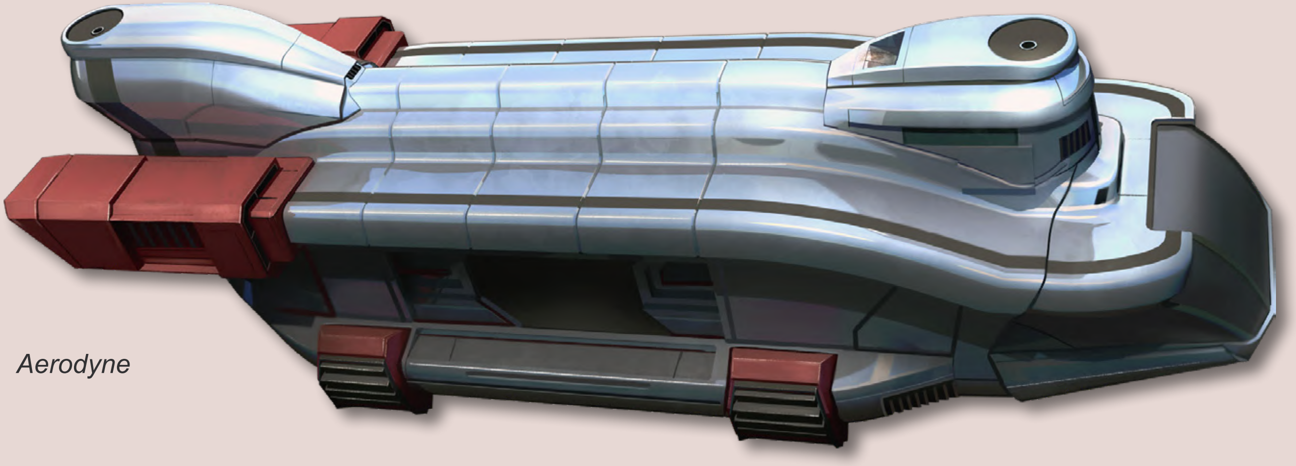
The Customisations chapter can add additional Costs per Space to a vehicle but these additions are computed from the initial base Cost per Space, not the base Cost modified by features.

AERODYNE

This feature transforms a rotorcraft into an aerodyne, a vehicle neither aeroplane nor helicopter but a wingless aircraft propelled by vectored jet engines. It is a flying car or truck and might have a bright future in a universe without grav vehicles. A pilot uses Flyer (rotor) skill to control an aerodyne. Much like a helicopter it is fully capable of VTOL flight and hovering but can fly faster with its jet engines. An aerodyne is subject to the same Airborne Movement restrictions (see page 20) as other aircraft, and a Streamlined aerodyne is capable of achieving Supersonic and Hypersonic Speed Bands with other features and modifications.

Features Available

Features	Aeroplane	Airship	Grav Vehicle	Ground Vehicle	Hovercraft	Rotorcraft	Structure	Submersible	Watercraft	Walker
Aerodyne	—	—	—	—	—	√	—	—	—	—
AFV	—	—	√	√	—	—	√	√	√	√
Agile	√	√	√	√	√	√	—	√	√	√
ATV	—	—	—	√	—	—	—	—	—	—
Biotech	√	√	—	√	√	√	√	√	√	√
Fast	√	√	√	√	√	√	—	√	√	√
Floats	√	—	—	—	—	√	—	—	—	—
Folding Wings	√	—	—	—	—	√	—	—	—	—
Hydrofoil	—	—	—	—	—	—	—	—	√	—
Hypersonic	√	—	—	—	—	—	—	—	—	—
Jet Engines	√	—	—	—	—	—	—	—	—	—
Locomotive	—	—	√	√	—	—	—	√	√	√
Monowheel	—	—	—	√	—	—	—	—	—	—
Multi-Legged	—	—	—	—	—	—	—	—	—	√
Off-Roader	—	—	—	√	—	—	—	—	—	—
Open Frame	√	√	√	√	√	√	√	√	√	√
Open-Topped	√	—	√	√	√	√	√	—	√	√
Ornithopter	—	—	—	—	—	√	—	—	—	—
Rail rider	—	—	—	√	—	—	—	—	—	—
Responsive	√	√	√	√	√	√	—	√	√	√
Rigid	—	√	—	—	—	—	—	—	—	—
Slow	√	√	√	√	√	√	—	√	√	√
Smart Wheels	—	—	—	√	—	—	—	—	—	—
STOL	√	—	—	—	—	—	—	—	—	—
Streamlined	—	√	√	√	√	√	√	—	—	—
Supersonic	√	—	—	—	—	—	—	—	—	—
Tilt Engines	√	—	—	—	—	—	—	—	—	—
Tracks	—	—	—	√	—	—	—	—	—	—
Tunneller	—	—	—	√	—	—	—	√	—	√
Unresponsive	√	√	√	√	√	√	—	√	√	√



Aerodyne

Tech Level	7
Applies to	Rotorcraft
Effect	Jet-propelled wingless flying craft
Prerequisite	Powered
Not Compatible with	Folding Wings, Ornithopter
Speed	+1 Speed Band
Shipping	x0.5
Added Cost	+30% base Cost

AFV

An Armoured Fighting Vehicle (AFV) is designed to withstand hostile or battlefield conditions. The main effects of this are to increase the maximum overall armour allowable at its Tech Level by three times and add +50% to the vehicle's Hull. To reflect its robust design, an AFV also gains the Off-Roader trait if it is a ground vehicle. Additional features such as ATV or Tracks can further improve upon an AFV's rough terrain handling. Although an AFV's speed is reduced by one Speed Band, adding the tracks feature will not further reduce its Speed.

Tech Level	5
Applies to	Grav Vehicle, Ground Vehicle, Structure, Walker, Watercraft
Effect	3x armour limit, +50% Hull, reduced Speed
Traits	AFV, Off-Roader
Not Compatible with	Hydrofoil, Open-Topped
Size Limits	Size 20+
Speed	-1 Speed Band
Added Cost	+100% base Cost

AGILE

A vehicle with this feature is designed to be particularly manoeuvrable, with a tighter turning radius, additional flaps, gyroscopes, or other methods to improve handling.

Tech Level	1
Applies to	Aeroplane, Airship, Grav Vehicle, Ground Vehicle, Hovercraft, Rotorcraft, Submersible, Walker, Watercraft
Effect	Locomotion optimised for greater Agility
Not Compatible with	Rail Rider
Agility	+1
Added Cost	+100% base Cost

ATV

The All-Terrain Vehicle (ATV) feature provides better handling in rough terrain using additional wheels, higher ground clearance and/or improved suspension.

Tech Level	0
Applies to	Ground Vehicle
Effect	No penalty for off-road travel. Able to traverse rough terrain.
Traits	ATV
Not Compatible with	Off-Roader, Rail Rider, Tracks
Added Cost	+30% base Cost

BIOTECH

A biotech vehicle is a living thing, constructed, modified or possibly just trained. It can function in the same manner as most vehicles, although it cannot naturally use grav technology for propulsion nor generate power via nuclear processes. A biotech vehicle has specialised traits and varying abilities. See the Biotech chapter starting on page 131 for further details on constructing biotech vehicles and determining how they might fit into a particular universe.

Tech Level	0
Applies to	Aeroplane, Airship, Ground Vehicle, Hovercraft, Rotorcraft, Structure, Submersible, Walker, Watercraft
Effect	See Biotech Chapter
Traits	Biotech (see text)
Agility	varies
Speed	varies
Range	varies
Shipping	varies
Added Cost	varies

FAST

This vehicle has a more powerful engine, at the cost of fuel efficiency or capacity. An aeroplane with this feature is still limited to Subsonic speeds and must instead add the supersonic or hypersonic features to achieve greater velocities.

Tech Level	0
Applies to	Aeroplane, Airship, Grav Vehicle, Ground Vehicle, Hovercraft, Rotorcraft, Submersible, Walker, Watercraft
Effect	Trades bigger engine for less fuel
Not Compatible with	Slow, Supersonic
Speed	+1 Speed Band
Range	x0.5
Added Cost	+100% base Cost

FLOATS

Floats allow an aeroplane or rotorcraft to land and take off from liquid surfaces. Either the landing gear section has boat-like outriggers attached or the fuselage of the aircraft itself is boat-shaped and buoyant. This allows the aircraft to land in wilderness areas where a prepared landing strip or pad is not available, or in harbour areas without an airfield.

Tech Level	4
Applies to	Aeroplane, Rotorcraft
Effect	Floats or body of aircraft supports water landings
Speed	-1 Speed Band
Added Cost	+20% base Cost

FOLDING WINGS

An aeroplane, helicopter, or ornithopter with folding wings has wings or blades which fold against the body, allowing the vehicle to be stored or transported in a smaller area.

Tech Level	4
Applies to	Aeroplane, Rotorcraft
Effect	Wings or rotors fold to reduce shipping volume
Not Compatible with	Aerodyne
Shipping	x0.75
Added Cost	+20% base Cost

HYDROFOIL

A watercraft with hydrofoils uses struts to raise its body above the surface of the liquid when at speed, reducing friction and allowing it to travel faster. A hydrofoil is more sensitive to the weight of the vehicle, making it unsuitable for armoured surface combat.

Tech Level	3
Applies to	Watercraft
Effect	Raises body of watercraft to reduce friction and increase Speed
Not Compatible with	AFV
Speed	+1 Speed Band
Added Cost	+200% base Cost

HYPERSONIC

A hypersonic aeroplane is designed with the aerodynamics, materials and engine intakes to support extremely fast flight. Adding this feature to an aeroplane automatically increases its maximum speed to Hypersonic. If the vehicle also has the fast feature, it can reach orbital velocity around a Size 6 world and each additional Speed customisation increases the Size of a planet it can orbit by +1.

Tech Level	8
Applies to	Aeroplane
Effect	Changes aeroplane Speed Band to Hypersonic
Prerequisite	Jet
Not Compatible with	Open Frame, Open-Topped, Supersonic
Range	x0.5
Added Cost	+400% base Cost

JET ENGINES

The jet engines feature allows an aeroplane to use internal combustion or similar technology jet engines for thrust. This covers various designs such as turbojets, turbofans, ramjets, pulse jets and other advanced high-speed engines. It is a prerequisite for both supersonic and hypersonic features and subject to the standard airborne movement restrictions based on a world's Atmosphere and Size. Jet engines require an aeroplane to be powered and jets on nuclear-powered engines can forgo fuel by producing thrust strictly from air superheated by exposure to the heat output of their reactors.

Tech Level	6
Applies to	Aeroplane
Effect	Uses Jet instead of propeller engines
Prerequisite	Powered
Speed	+1 Speed Band
Range	x1.5
Added Cost	+200% base Cost

LOCOMOTIVE

A locomotive is a vehicle optimised for carrying a large load. It trades interior Spaces for a much more powerful engine, granting it great ability to tow or push other vehicles but slowing changes to velocity. A locomotive will quadruple the towing capacity of the vehicle but also give it the Unresponsive trait, adding to the time it takes to increase or decrease speed. This option is often used for rail riders but is available for a variety of vehicle types, such as tractor-trailers and tugboats. A locomotive provides three times the amount of usable power as a normal vehicle of the same type and power source.

Tech Level	3
Applies to	Grav Vehicle, Ground Vehicle, Submersible, Walker, Watercraft
Effect	x4 towing capacity, Unresponsive, triple power points
Traits	Unresponsive
Prerequisite	Powered
Size Limits	Size 20+
Agility	-1
Added Cost	+50% base Cost

MONOWHEEL

This feature transforms a ground vehicle into essentially a one-wheeled motorcycle in which the vehicle's components and occupants sit inside the wheel itself. The monowheel can be an open-frame vehicle or an enclosed bubble inside the wheel, but it requires power to maintain the gyroscopes required for balance. In theory, a vehicle of any size can be a monowheel.

Tech Level	9
Applies to	Ground Vehicle
Effect	Manoeuvrable single wheel
Prerequisite	Powered
Not Compatible with	Tracks
Agility	+2
Speed	+1 Speed Band
Shipping	x0.5
Added Cost	+200% base Cost

MULTI-LEGGED

By default, a walker vehicle is a two-legged vehicle. This feature adds additional legs to provide for greater stability. Walkers already have the ATV trait by default but being multi-legged gains these vehicles an extra DM+1 to operator checks in rough terrain and can allow a walker to traverse some otherwise impassible terrain (see Terrain Movement on page 20).

Tech Level	8
Applies to	Walker
Effect	Walker with more than two legs. DM+1 on rough terrain
Prerequisite	Powered
Agility	+1
Added Cost	+100% base Cost

OFF-ROADER

Ground vehicles operate best on a road surface or on hard flat terrain. This feature allows a wheeled ground vehicle to operate normally in off-road terrain and venture into rough terrain.

Tech Level	0
Applies to	Ground Vehicle
Effect	No penalty for off-road travel. Able to traverse Rough terrain.
Traits	Off-Roader
Not Compatible with	ATV, Rail Rider, Tracks
Added Cost	+15% base Cost

OPEN FRAME

A vehicle with an open frame is ridden upon, not inside. This includes vehicles ranging from scooters, G/bikes, snowmobiles and personal watercraft. An open frame vehicle is limited in Size and cannot travel faster than Subsonic speeds within an atmosphere. Riders have the flexibility to see and fight in any direction and can exit the vehicle by simply jumping off, but they are not protected by the vehicle's armour.

Tech Level	0
Applies to	Aeroplane, Airship, Grav Vehicle, Ground Vehicle, Hovercraft, Rotorcraft, Structure, Submersible, Walker, Watercraft
Effect	Riders sit outside vehicle with no armour protection
Traits	Open Vehicle
Not Compatible with	Hypersonic, Open-Topped, Supersonic
Size Limits	Size 1-3
Agility	+1
Speed	+1 Speed Band
Range	x0.8
Shipping	x0.5
Added Cost	-30% base Cost

OPEN-TOPPED

An open-topped vehicle has no integral roof or top surface covering, although it might sport a removable soft cover to protect against the elements. Vehicles such as some jeeps, air/rafts and some pleasure boats are considered open-topped, but a flatbed truck with an enclosed cab is not. The occupants of an open-topped vehicle have full visibility in all directions except down but are only considered to have cover against side attacks.

An open-topped vehicle has no top armour and is limited to Subsonic speeds in atmospheres. It does not provide its occupants with environmental protections or vehicle-wide life support but is cheaper than its enclosed vehicle counterparts. The convertible option (see page 68) can transform a regular enclosed vehicle into an open-topped one but does not grant it this feature's Cost reduction.

Tech Level	0
Applies to	Aeroplane, Grav Vehicle, Ground Vehicle, Hovercraft, Rotorcraft, Structure, Submersible, Walker, Watercraft
Effect	No top armour, sides provide half cover
Traits	Open-Topped
Not Compatible with	AFV, Hypersonic, Open Frame, Supersonic
Added Cost	-15% base Cost

ORNITHOPTER

An ornithopter feature is considered a rotorcraft, although the wings flap instead of rotating and the pilot requires the Flyer (ornithopter) skill to be proficient. In most circumstances an ornithopter is less efficient, which is reflected in its reduced Range and lower speeds, but a properly designed and piloted ornithopter can be more agile than a helicopter and does not need to consider the torque created by rotors.

RAIL NETWORKS

A train is comprised of linked vehicles, usually running on a track. For some applications such as a light rail vehicle, all of the vehicles may be powered and use the rail rider feature (see page 41) to stay on tracks. In other cases, one or more locomotives tow multiple carriages. The towing rules (see page 23) apply to these situations.

Many trains use a vehicle with the Locomotive feature (see page 38) to tow unpowered or grid-powered carriage vehicles. In many applications, especially 'light rail' in urban environments, all of the vehicles could be powered vehicles running over a rail system. These are treated as independent Rail Rider ground vehicles but can take advantage of the features of various track types described below.

A rail network consists of tracks designed to support rail-riding vehicles. A rail network has a maximum safe Speed Band that varies with rail type, investment and technology. Doubling the cost of a rail track will increase the maximum safe Speed Band by one and the maximum safe Speed Band also increases at TL+2 from its introduction.

If a rail rider vehicle is operating beyond the railway's maximum safe Speed Band, the operator must make an Average (8+) skill check every minute to avoid a mishap, with an additional DM-2 for every additional Speed Band. Mishaps include damage to equipment (treated as a Severity 1 Critical Hit to Locomotion) or a derailment, an event that is treated as a collision at one Speed Band slower than the Speed Band at which the mishap occurred.

To travel faster than subsonic speed in an atmosphere, a rail rider must either be streamlined or travelling in a vacc tube rail network.

Rail Network Summary

Train/Railroad	TL	Speed Band	Maximum	Towing Bonus	Notes
Rail (primitive)	1	+1	Very Slow	None	Muscle power
Rail (basic)	3	+1	Slow	x2 Spaces	Can use grid power at TL5+
Rail (improved)	7	+2	Very Fast	x2 Spaces	Designed for high-speed rail
Rail (enhanced): Maglev	8	+3	Subsonic	x4 Spaces	All Rail Riders require grid power
Rail (advanced): Gravlev	13	+4	Supersonic	x5 Spaces	All Rail Riders require grid power and lifters
Vacc Tube rail	8	+2 (additional)	+2 (additional)	Same	Rail Riders should have vacuum protection and life support

Tech Level	8
Applies to	Rotorcraft
Effect	Flies like a bird using moving wings. Requires Flyer (ornithopter) skill to pilot.
Not Compatible with	Aerodyne
Agility	+1
Speed	-1 Speed Band
Range	x0.75
Shipping	x0.75
Added Cost	+20% base Cost

RAIL RIDER

These vehicles are designed to operate on tracks. At the lowest Tech Levels, this could be a vehicle running on wooden tracks and pulled by draft animals. At TL3 and above, metal rails, steam and later more advanced engines can propel the rail rider and at TL9 magnetic monorails become the norm. A powered rail rider can be a locomotive and tow numerous unpowered rail riders.

Tech Level	1
Applies to	Ground Vehicle
Effect	Locomotion limited to railroad tracks or monorails
Not Compatible with	Agile, ATV, Off-Roader, Tracked
Agility	-2
Speed	+1 Speed Band
Added Cost	+50% base Cost

RESPONSIVE

This feature grants the vehicle the Responsive trait, allowing it to accelerate and decelerate quickly. It can change Speed Bands twice as fast as a normal vehicle. The Responsive trait can also be used to counteract one condition causing an Unresponsive trait.

Tech Level	0
Applies to	Aeroplane, Airship, Grav Vehicle, Ground Vehicle, Hovercraft, Rotorcraft, Submersible, Walker, Watercraft
Effect	Reduces to half the time required to change Speed Bands
Traits	Responsive
Not Compatible with	Unresponsive
Range	x0.75
Added Cost	+100% base Cost

RIGID

A rigid airship is constructed with a lift-generating envelope attached to a fixed frame; a zeppelin is a rigid airship whereas a blimp is not. Use of vacuum to achieve lighter-than-air flight requires this feature. All rigid airships have greater range than a typical airship but they cannot be compacted for shipment or storage without disassembly of the rigid frame. This process takes 1D days, or 2D days for Massive airships, and allows them to be shipped and stored like a non-rigid airship.

Reassembly takes a similar number of days and requires an Average (8+) Mechanic check. Failure means adding the negative Effect to the number of days of assembly before trying the check again.

At TL12 and above, a rigid airship ‘filled’ with vacuum or gas can essentially disassemble its envelope, folding up origami-style in 1D minutes and unfolding again in a similar timeframe.

Tech Level	4
Applies to	Airship
Effect	Rigid frame to provide better range, but harder to ship or store
Range	x1.5
Shipping	x5
Added Cost	+200% base Cost

SLOW

This vehicle has sacrificed power for range, using a smaller engine and usually larger fuel tanks to lower the cost of the vehicle in return for a sacrifice in performance. Additional customisations can further alter speed and range at a detriment or benefit to Spaces. A vehicle cannot use this feature to reduce a vehicle’s speed to the Stopped Speed Band and most aeroplanes cannot use it if their maximum Speed Band is reduced to Very Slow.

Tech Level	0
Applies to	Aeroplane, Airship, Grav Vehicle, Ground Vehicle, Hovercraft, Rotorcraft, Submersible, Walker, Watercraft
Effect	Trades smaller engine for more fuel
Not Compatible with	Fast
Speed	-1 Speed Band
Range	x1.5
Added Cost	-25% base Cost

SMART WHEELS

A ground vehicle with smart wheels uses short-ranged sensors to scan the ground ahead and make minute changes to the shape and pressure of wheels to compensate for conditions, granting DM+1 to any Drive check made under adverse conditions. Smart wheels also increase the range of a vehicle. Despite the name, the feature is also available on ground vehicles with the Tracks or Rail Riders features. Additional benefits of Smart Wheels are detailed in Terrain Movement on page 20.

Tech Level	9
Applies to	Ground Vehicle
Effect	DM+1 in adverse conditions; +10% range; lowers terrain penalty by 1
Agility	+1
Range	x1.1
Added Cost	+130% base Cost

STOL (SHORT TAKEOFF AND LANDING)

An aeroplane with STOL capability is designed to operate on runways and landing fields in half the length of a conventional aeroplane. These vehicles tend to have lower stall speeds and require less velocity to achieve lift. A STOL aeroplane whose maximum Speed Band is Slow can maintain flight at a cruising speed of Very Slow.

Tech Level	4
Applies to	Aeroplane
Effect	Take-offs and landings require half runway space
Added Cost	+30% base Cost

STREAMLINED

A streamlined vehicle is designed with an aerodynamic hull to achieve greater performance. This allows grav and ground vehicles to exceed Subsonic speeds in an atmosphere but only rotorcraft that are aerodynes can exceed Subsonic speed; those with spinning rotors or flapping wings benefit from being streamlined but cannot function at Supersonic speeds. Streamlining does not apply to aeroplanes, submersibles or watercraft, which rely on different features to achieve greater performance. A structure that is streamlined can act as the body of a rocket (see Rocket Thruster, page 52).

Tech Level	1
Applies to	Airship, Grav Vehicle, Ground Vehicle, Hovercraft, Rotorcraft, Structure
Effect	Aerodynamic hulls for non-aeroplanes
Not Compatible with	Tunneller
Agility	+1
Speed	+1 Speed Band
Added Cost	+200% base Cost

SUPERSONIC

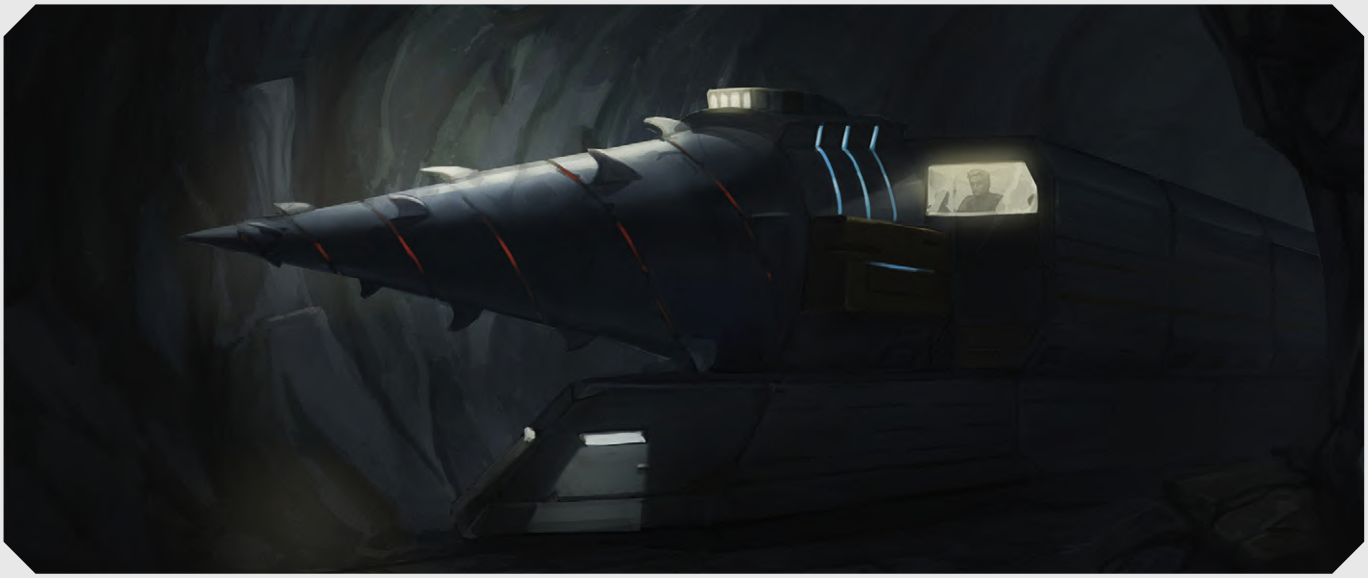
Aeroplanes have specific requirements to enable flight faster than the speed of sound, including aerodynamics and engine performance. This feature enables the aeroplane's speed to reach Supersonic but note that the jet feature is a prerequisite for Supersonic flight. The maximum speed of a supersonic vehicle cannot be increased further with other features or customisations.

Tech Level	6
Applies to	Aeroplane
Effect	Changes aeroplane Speed Band to Supersonic (9)
Prerequisite	Jet
Not Compatible with	Fast, Hypersonic, Open Frame, Open-Topped
Range	x0.8
Added Cost	+200% base Cost

TILT ENGINES

Tilt engines provide rotor or jet engines on an aeroplane with the ability to rotate and generate vertical thrust for VTOL operations, eliminating the need for a runway or landing strip. While tilt engines normally cause a reduction of one Speed Band, they do not reduce the speed of a supersonic or hypersonic aeroplane; they only add to its Cost.

Tech Level	8
Applies to	Aeroplane
Effect	Aeroplane engines tilt to allow VTOL
Traits	VTOL
Speed	-1 Speed Band
Added Cost	+100% base Cost



TRACKS

A ground vehicle with tracks uses treads instead of wheels to contact the ground, providing superior performance on rough terrain at the cost of overall speed. A vehicle with both the AFV and tracks features suffers only one Speed Band reduction rather than one from each.

Tech Level	5
Applies to	Ground Vehicle
Effect	Allow ground vehicle to traverse rough terrain but Speed reduced
Traits	Tracked
Not Compatible with	ATV, Monowheel, Off-Roader
Speed	-1 Speed Band
Added Cost	+100% base Cost

TUNNELLER

A tunneller is a ground vehicle with large drills or other boring equipment. Only Heavy or larger vehicles can use this feature and their movement rate through solid rock, regolith or hard soil is equal to the vehicle's Tech Level in metres per hour, doubling at TL8 and above. Unless arrangements are made to clear away the material drilled by the tunneller, it will not be able to back up while underground. The diameter of the tunnel cut by the drill is equal to the cube root of the number of Spaces the vehicle has. For instance, a vehicle of 27 Spaces makes a tunnel three metres wide, while a vehicle of 64 Spaces makes a passage four metres wide. A 1,000-Space vehicle can make a 10 metre wide tunnel.

Tech Level	7
Applies to	Ground Vehicle, Submersible, Walker
Effect	Allows ground vehicle to tunnel through rock at a rate of TL×1 m/hour, doubled at TL8+
Not Compatible with	Streamlined
Size Limits	Size 20+
Agility	-1
Speed	-1 Speed Band
Added Cost	+800% base Cost

UNRESPONSIVE

This feature inflicts the Unresponsive trait upon the vehicle. Such a vehicle accelerates and decelerates slowly and takes twice as long to change Speed Bands. If the vehicle is not already unresponsive it can be applied to a design deliberately to save costs.

Tech Level	0
Applies to	Aeroplane, Airship, Grav Vehicle, Ground Vehicle, Hovercraft, Rotorcraft, Submersible, Walker, Watercraft
Effect	Doubles time needed to change a Speed Band
Traits	Unresponsive
Not Compatible with	Locomotive, Responsive
Added Cost	-25% base Cost

CUSTOMISATION

Size, type and features describe many aspects of a vehicle, which is enough to begin outfitting one with optional components, armour and weapons. However, others might have additional customisations that affect mobility, including enhancements to a vehicle's power system, alternate modes of travel and further customisation of speed and range. These customisations affect the number of Spaces available for installation of other components. Costs related to base Cost per Space of a vehicle apply to the original base Cost per Space, not the Cost modified by features.

SPACECRAFT-SCALE POWER

A vehicle is assumed to have enough power available to operate its systems and manoeuvre at its maximum speed. In most cases, this is a reasonable assumption but when adding power-hungry spacecraft-scale options, they may exceed its power capability.

Systems requiring spacecraft Power to operate will not function without a fission, fusion or Fusion+ system. These three are referred to as 'nuclear' power systems for brevity. A Power point value per Space compatible with the power output of spacecraft is associated with each of these nuclear power options.

A vehicle can fire spacecraft-scale weapons and operate spacecraft-scale systems normally if they require less than 10% of the vehicle's total Power. If the spacecraft-scale system requires more, the vehicle must temporarily reduce its maximum Speed Band by one for every full 10% of Power shortage and might need to be stationary to fire more power-hungry weapons. If the systems require more than 100% of the vehicle's Power, they cannot be operated at all. To support additional power, the vehicle can install more Spaces of its nuclear power system.

POWER PLANTS

By default, a vehicle is powered by common methods of the appropriate Tech Level (steam engines, internal combustion engines, batteries, fuels cells or similar technologies), or else they are unpowered. The basic properties of a vehicle, such as Speed, Range, Shipping tonnage and Cost per Space all assume that a vehicle is powered. At Tech Levels below 3, a standard power system is unavailable but a vehicle can rely on natural systems, such as wind or muscle to provide movement.

SECONDARY POWER

A vehicle can have both a primary and secondary power source. Examples of this range from a trireme powered by wind and muscle, a screw frigate powered by wind and steam, and a bus running on electricity from connections to power lines but on diesel when operating on secondary routes.

In some cases, a secondary power plant could have differing Space requirements than as a primary power plant. For example, a secondary grid or beam power system consumes Spaces; they do not provide additional usable Spaces as they would if they were the only source of power. A vehicle designed as unpowered may not install a secondary power system, nor may a vehicle remove a power system and then install it as a secondary system.

If a vehicle installs a secondary standard power system – for example, as a backup to another mode – that powered system consumes 30% of the vehicle's Spaces and is 100% of the vehicle's base Cost.

If a vehicle is operating on only a secondary power system, it has its Speed Band reduced by one (but not below Idle) and its Range halved. This does not apply to wind and muscle secondary systems, which will operate at the Speed Band indicated for the power system at its Tech Level and have theoretically unlimited range. Grid and beam secondary systems are likewise not reduced in performance. Minimum Space restrictions on power system size still apply to all secondary power systems and Cost per Space remains the same.

Structure Primary Power

Power	Spaces	Cost per Vehicle Space	Notes
Unpowered	—	—	Default at TL0-2
Grid Power	—	—	Default at TL3+
Beamed Power	20%, minimum 2	Cr10000	Available at TL8+
Powered	30%, minimum 1	100% of base Cost	Available at TL3+

STRUCTURES

A structure by default does not have an internal primary power source. At TL3 and above, it is considered to have grid power connections suitable for its Tech Level as its primary power source at no added Cost (whether they be gas light plumbing, electrical wires or induction surfaces).

A structure is already considered to be a box, cylinder, sphere or some other space-efficient shape to account for its extra Spaces of internal capacity and does not receive another Cost or Space discount for being unpowered. Any structure may install a secondary power source if desired.

UNPOWERED VEHICLES

A vehicle without a power source is essentially immobile on its own. It has a locomotion system and may have a power distribution system but is dependent on external factors for movement. This is an appropriate property for a raft-like watercraft subject only to the forces of currents and tides, and for a vehicle being towed such as a trailer or rail car. A glider is an example of an unpowered aeroplane.

An unpowered vehicle has the following modifications.

Tech Level	0
Spaces	50% Spaces gained, minimum 1 Space
Not Usable with	Grav Vehicle, Hovercraft, Rotorcraft, Submersible, Walker
Speed	Stopped
Cost	-80% of base Cost

Similar to a structure, an unpowered vehicle has +50% more internal Spaces available for other purposes but options affecting the vehicle as a whole are applied to the base 100 Space size of the vehicle; an unpowered vehicle with 100 Spaces can utilise 150 Spaces for internal components.

If a vehicle is unpowered, it cannot install a secondary power system to take advantage of the Space and Cost benefits of being unpowered. Instead, if it was modified to become a powered vehicle in the future, it must use its extra Spaces to install the power system and spend a Cost equivalent to the initial base Cost advantage, plus +10%. See the Modifications chapter for further discussion of vehicle alterations.

MUSCLE POWER

A vehicle powered by muscle is driven by the force of crew or draft animals. Examples include a rowboat, canoe, rickshaw, wagon, galley or a canal boat pulled by animals. Muscle-powered aeroplanes are possible but very limited in size and range and require further modifications to reach minimum Speed Band requirements.

Tech Level	0
Spaces	+40% Spaces gained, minimum 1 Space
Not Usable with	Airship, Grav Vehicle, Hovercraft, Walker
Speed	Idle
Cost	-70% of base Cost

If muscle power is added as a secondary system, it will consume 5% of the vehicle's Spaces at a cost of Cr100 per Space installed. Muscle power reduces a vehicle's Speed Band to Idle by default. See Design Limits on page 26 for further discussion.

Muscle power requires a crew aboard or connected to the vehicle, although an external 'crew' usually comprises draft animals pulling a wagon or barge, while a muscle-powered rickshaw could be powered by either. A bicycle is technically a single-Space muscle-powered open frame ground vehicle.

More common crewed vessels include a rowboat or a galley. For optimised operation, a galley or trireme would have two rowers for every three Spaces, although a slower cargo ship might only have one rower per four or five Spaces. The number of rowers per Space affects the tactical movement capabilities of a muscle-powered warship.

WIND POWER

A wind-powered vehicle is assumed to be propelled by one or more sails, although there is no reason it could not be a windmill driving a screw propeller or spinning a wheel axle. Wind vehicles are subject to atmospheric effects and the prevailing direction and strength of air currents. As with airborne movement (see page 20), they are subject to penalties if transferred to a world with differing atmospheric or gravity conditions. Although a wind-powered vehicle designed for a Thin or Standard atmosphere could potentially travel faster on a world with a Dense atmosphere, it is just as likely its materials would be too fragile to use the increased force of the winds.

Tech Level	1
Spaces	+20% Spaces gained, minimum 1 Space
Not Usable with	Grav Vehicle, Hovercraft, Submersible, Walker
Speed	As Wind Powered Speed table
Shipping	x2
Cost	-60% of base Cost

If wind power is added as a secondary system, it will consume 25% of the vehicle's baseline Spaces at a cost of Cr200 per Space installed.

Wind Powered Speed

TL	Speed
0–4	Idle
5–8	Very Slow
9+	Slow

Sailing ships require a large crew, ideally one sailor per 25 Spaces to rig and prepare for movement but during actual operations, with sails deployed, crew requirements can be much lower.

GRID POWER

A grid power source is a power grid or power plant not directly associated with the vehicle. Grid power is suitable for structures and land vehicles such as ground vehicles or walkers designed to operate in regions with the infrastructure to support them. These vehicles are often connected via an overhead network of power lines, powered rail network or induction grid built into a roadway. Such vehicles work well on prepared transportation networks but are entirely useless once the vehicle leaves a well-defined grid; those vehicles would require a secondary power source to operate off grid.

Tech Level	4
Spaces	+40% Spaces gained, minimum 1 Space
Not Usable with	Aeroplane, Airship, Grav Vehicle, Hovercraft, Rotorcraft, Submersible, Watercraft
Cost	+100% of base Cost

If grid power is installed as a secondary power source, it requires 10% of a vehicle's Spaces and costs 100% of the vehicle's base Cost.

BEAMED POWER

Sea and air vehicles may use transmission of power across distances. This can be accomplished by beaming targeted microwaves (masers) or other electromagnetic radiation across distances. Such beamed power systems are reliant on a line-of-sight between transmitter and receiver but can expand the reach of power to areas surrounding a power grid. Airborne vehicles relying solely on beamed power are assumed to have limited battery backup capability of at least five minutes to allow a hasty landing if unable to maintain a beamed power link, but many vehicles relying on beamed power have a full secondary power system to allow operation beyond the limits of the grid's line of sight.

Tech Level	8
Spaces	+30% Spaces gained, minimum 1 Space
Not Usable with	Submersible
Cost	Cr10000 per vehicle Space

As a secondary power source, beamed power consumes 20% of a vehicle's Spaces and costs Cr10000 per vehicle Space, with a minimum consumption of two Spaces. A vehicle (or more likely structure) with beamed power as both primary and secondary power sources can act as a power relay, if built like a tower and placed on a high point. Airborne or seaborne power relays are also a possibility. A beamed secondary power source does not reduce the Speed Band or Range of a vehicle.

FISSION POWER

A fission power plant is a self-contained nuclear reactor that uses uranium or thorium fission to power a vehicle for a very long time. A fission plant must be entirely replaced and safely disposed of after it reaches its endurance limit. Since this costs twice as much as the original power plant, fission vehicles are

Fission	TL	Spaces*	Endurance	Cost per Power Plant Space	Power per Space
Basic	6	50%	10 years	Cr100000	2
Improved	7	40%	25 years	Cr150000	2.2
Advanced	8	30%	50 years	Cr200000	2.4

* A fission power plant consumes a minimum of 10 Spaces. A secondary fission power plant requires 70% of the Spaces of a primary plant but still a minimum of 10 Spaces.

usually scrapped once they run out of fuel. A vehicle with a fission plant requires the hostile environment protection option (see page 63) to prevent occupants or nearby bystanders from receiving 1D rads every day of operation. A fission plant can operate at reduced power while the vehicle is stationary but to fully shut it down requires an Average (8+) Engineer (power) check (1D hours, EDU). Once powered down, an equivalent task is necessary to bring the reactor back online. Whether shut down or not, the radioactive decay of its components limits its operational life to the endurance listed.

FUSION POWER

A fusion power plant is a self-contained nuclear reactor capable of fusing hydrogen or helium isotopes to provide power. While a fusion reactor can confine radioactivity to its reactor vessel and eliminate the risk of radiation exposure to crew and bystanders, it still requires careful disposal at twice the cost of the initial unit at the end of its useful life. The task to fully shut down or restart a fusion reactor is the same as that required for a fission reactor but a fully shut-down reactor does not 'age' and can be stored indefinitely.

ANTIMATTER

An antimatter powerplant is an armoured and sealed container for storage of antimatter and containment of its reactions with conventional matter to produce energy. An antimatter powerplant requires only six seconds to power on or off and can remain in a powered-down state indefinitely.

FISSION AND FUSION FUEL

The reactors of fission and fusion power plants do not need to be 'refuelled' for decades but their cooling and heat transference systems use unrefined spacecraft fuel or other liquids to transfer heat, absorb radiation and moderate reactions. These power plants require replenishment of this material by adding one Space of 'fuel' to the power plant for every 10 Spaces of power plant for every four weeks of operation. Watercraft and submersibles operating in water or other liquids with hydrogen as a component (ammonia, methane and so on) are assumed to continually top off this supply.

The Referee can choose to ignore this requirement but it is included to make vehicle and spacecraft power systems comparable. A similar requirement for adding normal matter and cooling fluid to an antimatter power system is also an option.

Fusion Power

Fusion	TL	Spaces*	Endurance	Cost per Power Plant Space	Power per Space
Basic	8	25%	50 years	Cr125000	2.5
Improved	12	20%	100 years	Cr250000	3.5
Advanced	15	10%	100 years	Cr500000	5

* A basic or improved fusion plant consumes a minimum of 10 Spaces, while an advanced fusion plant consumes a minimum of five Spaces. A secondary fusion power plant requires 60% of the Spaces of a primary plant, still requiring the same minimum Spaces.

Antimatter

	TL	Spaces*	Endurance	Cost per Power Plant Space	Power per Space
Antimatter	20	10%	100 years	MCr2.5	25

* An antimatter power plant consumes a minimum of four Spaces. A secondary antimatter power plant requires 60% of the Spaces of a primary plant but still a minimum of four Spaces.

Fusion+ Power

Fusion+	TL	Spaces*	Range†	Cost per Power Plant Space	Power per Space
Basic	10	10%	x5	Cr15000	1
Improved	13	10%	x15	Cr25000	2
Advanced	16	10%	x25	Cr50000	3

* A Fusion+ plant requires a minimum of one Space. A secondary fusion+ power plant requires 50% of the Spaces of a primary plant, still requiring a minimum of one Space.

† Range is multiplied by this value, using water filtered by the plant's intakes as fuel. Refuelling with deuterium-enriched water increases range by a further x3 but costs Cr1000 per Space consumed by the power plant and is only available on industrial worlds of TL6 and above, or any world of TL10+ with at least a Class D starport. A secondary Fusion+ power plant has half the range of a primary Fusion+ unit.

FUSION+ POWER

A Fusion+ power plant uses nuclear damper and gravitic technologies to greatly decrease the temperatures and energies required to sustain nuclear fusion and allows for compact, lightweight power plants suitable for small vehicle usage. These power plants greatly increase endurance and range but require regular or deuterium-enriched water as fuel. Fusion+ plants pose no radiation danger and can be started and shut down as easily as any conventional engine system.

SOLAR POWER

When operating within a star's habitable zone, Solar power provides a vehicle with unlimited endurance during the day and can charge internal batteries to provide up to three hours of cruising speed movement during the night or when the star is obscured. Vehicles operating closer to the star are generally limited by onboard electronics and cannot generate significantly more power. Those operating beyond only deliver

Solar Power	TL	Spaces*	Endurance	Cost per Power Plant Space
Basic	8	20%	25 years	Cr50000
Improved	10	10%	50 years	Cr100000
Advanced	12	5%	100 years	Cr150000

* Solar panels and batteries consume a minimum of two Spaces. A secondary solar panel power plant consumes 50% of the Spaces of a primary solar power plant, still consuming a minimum of two Spaces.

enough power to operate a vehicle at reduced Speed Bands; one less at the outer edge of the habitable zone, two (or more) less in the outer system. The Cost to replace a solar power system's panels and batteries when they reach the end of their useful life is 125% the initial cost per Space of the power system.

SPEED MODIFICATIONS

A vehicle may have customisations that affect its maximum Speed Band. These include more powerful engines, better streamlining or lighter components to increase speed in addition to or in place of those achieved by features. Conversely, smaller engines, cheaper or less efficient materials, components or other compromises can reduce maximum and cruise speeds to save Cost.

While a specific vehicle might not be able to travel beyond the speed of sound, if its 'theoretical' speed increases beyond Subsonic then both its maximum and cruise speeds are Subsonic, and it can take advantage of the Range advantage of cruising at Subsonic speed. Likewise, a Supersonic or Hypersonic vehicle with a positive speed modification can 'super-cruise' or 'hyper-cruise' at the same velocity as their maximum Speed Band. Aeroplanes with the supersonic or hypersonic features cannot use the Slower speed modification to save Spaces.

Each speed customisation can be applied up to three times or to the Speed Band limit. Space calculations are computed for each instance; for example, if a vehicle of 12 Spaces applies Faster twice, it costs three Spaces each time and if a vehicle of nine Spaces applies Slower twice, neither instance will gain it a Space.

Note that both speed customisations can be used with either the fast and slow features, although the only useful combination is to make the vehicle slower to gain Spaces and then use the fast feature to counteract one Speed Band loss.

RANGE MODIFICATIONS

A vehicle might have customisations that affect its range. This can be accomplished either by changing the efficiency of locomotive components or capacity of fuel tanks. Range change percentages from fuel capacity and fuel efficiency customisations are added together and then applied to the vehicle's Range after it has been adjusted by other factors such as features or Fusion+ power plants.

FUEL EFFICIENCY

A vehicle can alter its range by increasing or decreasing the fuel efficiency of its locomotion system. This does not change the number of Spaces

HOW FAST IS FAST?

A vehicle's top Speed Band represents a range of speed. Not all vehicles will necessarily top out at the highest velocity in that Speed Band but for skill checks and vehicle combat, that range covers the capabilities. In a race, if both vehicles are capable of travelling Very Fast, it is the Effect of the drivers' skill checks that determines who wins or who avoids a crash.

Likewise, a Speed Band does not translate directly into a vehicle's acceleration in comparison to a spacecraft's manoeuvre drive or reaction drive. Different vehicle types have different rates of acceleration. As a rough estimate of spacecraft-like performance – usually only applicable to airplanes or grav vehicles – assume a vehicle's base acceleration is no more than 1G. The Fast trait adds +1G (Streamlined does not) and any Faster speed modifications add +1 per positive modification (a Slow trait or Slower modification does not subtract one each but does make it unlikely that the vehicle can ever exceed 1G). The Open Frame trait may add +1, if it makes sense for the particular vehicle. Responsive will tend to double the vehicle's acceleration and Unresponsive will halve it. However, these values may only approximate those of a spacecraft in vacuum conditions. Many vehicles have a maximum speed limited by atmosphere and once they reach that maximum they are no longer accelerating.

Speed Modifications

Effect	TL*	Speed	Spaces	Limit	Cost
Faster	4	+1 band	-20% (round up)	Orbital speed	+100% of base Cost
Slower	4	-1 band	+10% (round down)	Idle speed	-10% of base Cost

* At TL4 only +1/-1 is available, +2/-2 requires TL5 and +3/-3 requires TL6.

allocated to Range but does increase or decrease the Cost of the vehicle by altering the characteristics of its engine efficiency.

Effect	TL*	Range	Cost
Increased Efficiency	3	+50%	+25% of base Cost
Decreased Efficiency	3	-25%	-10% of base Cost

* At TL3 only +50%/-25% is available, up to +100%/-50% requires TL4 and up to +150%/-75% requires TL5.

Increases or decreases in efficiency can be done up to three times or as Tech Levels allow, with percentage changes to both Range and Cost calculated from the initial values.

FUEL CAPACITY

A vehicle can increase or decrease its fuel capacity to alter the number of Spaces allocated for fuel. This does not change the Cost of the vehicle but will affect the number of Spaces available for internal use.

Use the Fuel Capacity table to calculate the Spaces lost or gained by changing fuel capacity. A vehicle must have enough Spaces available for each increase or decrease of Range. Decreasing fuel can be applied twice (for -50% Range and +20% to available Spaces), while increasing fuel can be applied multiple times so long as Spaces are available.

Fuel Capacity

Effect	TL	Range	Spaces
Increased Fuel	3	+25%	-10% (round up)
Decreased Fuel	3	-25%	+10% (round down)

AUXILIARY DRIVES

A vehicle may install an auxiliary drive system to allow it to function in differing environments, for example, to allow a land vehicle to travel over water or an aeroplane to drive like a ground vehicle. There are also specialised systems such as supercavitating drives for submersibles, rail wheels to allow a vehicle to transfer onto a track system, lifters to grant flying motive and hovering capability to any vehicle, and rocket thrusters to add speed and/or altitude.

FUEL CAPACITY FOR LARGE VEHICLES

Rather than use large increments of fuel tank changes, larger vehicle designs can alter fuel capacity one Space at a time, otherwise the large blocks of Spaces required can hinder the design of a fully functional vehicle. The percent change in Range from adding or subtracting a Space of fuel capacity is equal to the number of fuel spaces changed times 2.5 divided by the total number of vehicle Spaces, or:

$$\text{Range Modifier (\%)} = \frac{\text{Change in Fuel Spaces} \times 2.5}{\text{Total Vehicle Spaces}}$$

Auxiliary drives always require Spaces to install and cannot use features or customisations available to a vehicle's primary form of locomotion to further modify performance. Instead, performance of an auxiliary drive is based upon that of an equivalent standard primary system but usually at reduced Speed Bands, Agility and Range. In all cases an auxiliary drive is capable of at least Idle speed.

AQUATIC DRIVE

A vehicle with a secondary aquatic drive can traverse the surface of water, allowing it to operate as a watercraft. It cannot be used to cross large bodies of water but is adequate for navigating rivers, lakes and coastal areas. The modification includes waterproofing, snorkels and propellers or water jets for propulsion.

Tech Level	4
Speed	-1 Speed Band of equivalent TL Watercraft
Agility	-1 Agility of equivalent Watercraft
Range	10% Range of equivalent TL Watercraft
Spaces consumed	5% of Vehicle Spaces, 1 minimum
Cost per Vehicle Space	Cr1500

GRAV DRIVE

An auxiliary grav drive allows a ground or water vehicle to fly for a limited distance. However, it could also be an aeroplane with an auxiliary grav drive allowing it to fly outside an atmosphere for limited periods.

Tech Level	10
Speed	-1 Speed Band of equivalent TL Grav Vehicle
Agility	-1 Agility of equivalent Grav Vehicle
Range	50% Range of equivalent TL Grav Vehicle
Spaces consumed	25% of Vehicle Spaces, 1 minimum
Cost per Vehicle Space	Cr20000

Adding an auxiliary grav drive to a vehicle will grant it the VTOL trait while the drive is operating.

GROUND DRIVE

While many flying vehicles have a simple set of wheels that allow them to manoeuvre slowly under their own power at an airport or starport, a true ground drive system converts a flying (or floating) vehicle into a fully capable wheeled ground vehicle. The installation of a ground drive system is what makes a true 'flying car'.

Tech Level	4
Speed	Same Speed Band as equivalent TL Ground Vehicle
Agility	-1 Agility of equivalent Ground Vehicle
Range	50% Range of equivalent TL Ground Vehicle
Spaces consumed	5% of Vehicle Spaces, 1 minimum
Cost per Vehicle Space	Cr3000

LEG DRIVE

A vehicle can use legs as an additional form of locomotion. When in use, the vehicle gains the ATV trait and the ability to 'hop' over low obstacles. The hop allows a jump of height and length in metres equal to half the vehicle's TL, rounded down, and is not compatible with the AFV trait. An aeroplane with leg drive gains the STOL trait.

Tech Level	8
Speed	-1 Speed Band of equivalent Walker
Agility	-1 Agility of equivalent Walker
Range	50% Range of equivalent Walker
Spaces consumed	10% of Vehicle Spaces, 1 minimum
Cost per Vehicle Space	Cr20000

LIFTERS

While a grav drive allows a vehicle to operate at high speeds and away from a world's atmosphere, lifters are a more limited technology. Lifters counteract the influence of gravity on a vehicle, allowing it to float above the ground. By angling lifter plates a vehicle can move upward and laterally, but speed is limited to Very Slow and lifters only function within one planetary diameter of a world.

Tech Level	10
Speed	-5 Speed Band of equivalent TL Grav Vehicle
Agility	-3 Agility of equivalent Grav Vehicle
Range	10% Range of equivalent TL Grav Vehicle
Spaces consumed	10% of Vehicle Spaces, 1 minimum
Cost per Vehicle Space	Cr5000

A vehicle gains the VTOL trait when using lifters. Lifters consume power; for each hour a vehicle uses lifters, its primary locomotion Range is reduced by 50 kilometres.

Lifters allow structures to fly but their effect cannot be combined with land or water locomotion.

A combination of lifter and rocket thruster propulsion is possible and will reduce the required rounds of Thrust to reach orbital velocity by 25% (see Reaching Orbit on page 18).

RAIL WHEELS

Vehicles other than rail riders may have rail wheels (or equivalent) as an additional feature, allowing them to operate upon rail tracks. A ground vehicle with rail wheels can use rails even if other features, such as ATV, would normally prevent this.

Tech Level	1
Speed	Same Speed Band as equivalent TL Ground Vehicle
Agility	-2 Agility of equivalent Ground Vehicle
Range	100% Range of equivalent TL Ground Vehicle
Spaces consumed	5% of Vehicle Spaces, 1 minimum
Cost per Vehicle Space	Cr400

SUBMARINE DRIVE

This customisation involves both locomotion and waterproofing elements, allowing a vehicle to operate completely submerged. Depending upon its density, it might either be able to operate underwater or only on the seafloor. If a vehicle has the AFV trait and more armour than a standard vehicle can support, unless its primary type is watercraft, it will not be able to maintain neutral buoyancy and will sink to the seafloor unless actively manoeuvring. Vehicles that can maintain neutral buoyancy are equipped with a snorkel system and, as long as they stay within five metres of the surface, do not need life support installed. Those who wish to dive further or are unable to stay buoyant should have at least a short term life support system or seats installed if intending to remain underwater for more than a number of hours equal to half its Tech Level, rounded down. The Safe and Crush Depths of a vehicle with the submarine auxiliary drive is half that of an equivalent submersible, or equal to that of a submersible if it is an AFV. This option includes hostile environment protection.

Tech Level	6
Speed	-1 Speed Band of equivalent TL Submersible
Agility	-1 Agility of equivalent Submersible
Range	50% Range of equivalent TL Submersible
Spaces consumed	10% of Vehicle Spaces, 1 minimum
Cost per Vehicle Space	Cr3000

TRACK DRIVE

A vehicle can use tracks as an additional form of locomotion. Rather than being the primary drive, these tracks can extend and operate when needed. When operating, a track drive grants the ATV trait.

Tech Level	6
Speed	-2 Speed Band of equivalent Ground Vehicle
Agility	-1 Agility of equivalent Ground Vehicle
Range	50% Range of equivalent Ground Vehicle
Spaces consumed	10% of Vehicle Spaces, 1 minimum
Cost per Vehicle Space	Cr1000

SPECIALISED DRIVES

This section includes two specialised drives. A submersible can use a supercavitating drive to achieve high velocities and nearly any vehicle can use rocket thrusters, either to enhance performance, gain the ability to briefly fly or to become a rocket or rocket stage.

SUPERCAVITATING DRIVE

A supercavitating drive surrounds a submersible with a bubble of atmosphere and propels the vessel forward with rockets, jets or thrusters. This eliminates friction surrounding the vehicle and enables high-speed underwater transit. When in use, a supercavitating drive eliminates stealth and is limited in range by the propellent required to speed it through the water, so is normally used as a short-range tactical drive, not as a primary mode of propulsion. When the supercavitating drive is not in operation, the submersible operates at normal speeds for its Tech Level and any other features or modifications.

ROCKET THRUSTERS

A rocket is an engine that delivers thrust by expelling propellant at high velocity. Normally, this propellant includes both fuel and oxidiser, allowing the rocket to operate outside an atmosphere. Airbreathing rockets, those which use an atmosphere as oxidiser, are among the jet engine types used by supersonic and hypersonic aeroplanes and are not considered as rockets here. Rockets may use either liquid or solid propellants.

Supercavitating Drive

Supercavitation	TL	Speed	Range	Spaces*	Cost per Vehicle Space
Basic	8	Very Fast	50	40% of Vehicle Spaces	Cr500000
Improved	10	Very Fast	100	30% of Vehicle Spaces	Cr400000
Enhanced	12	Subsonic	150	20% of Vehicle Spaces	Cr250000
Advanced	14	Subsonic	150	10% of Vehicle Spaces	Cr100000

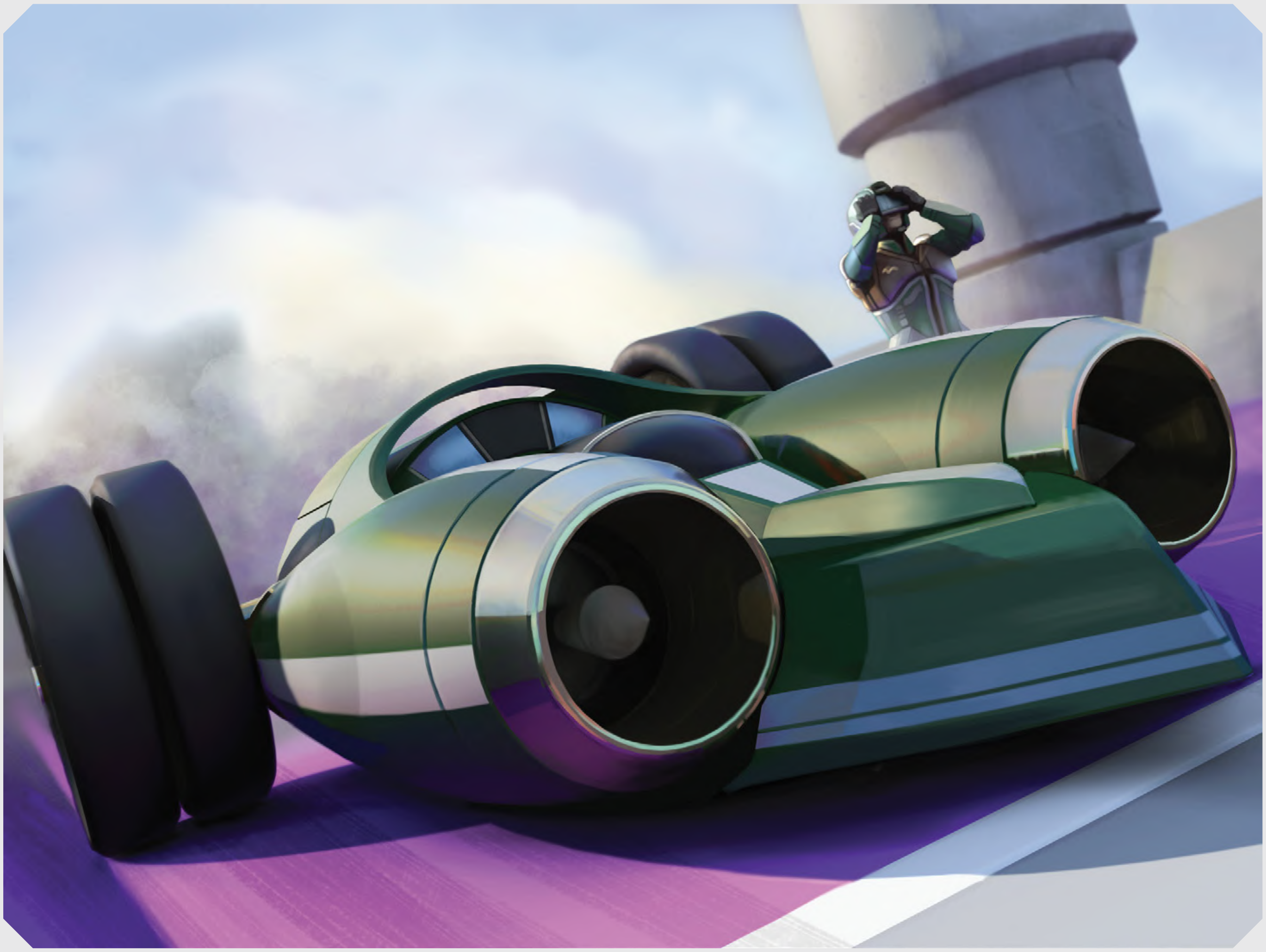
* Supercavitating drives consume a minimum of 10 Spaces

The Spaces consumed by a rocket thruster include both the rocket engines and their propellants, plus any required ancillary systems. Rocket thrust is high but generally short-lived. The number of Spaces consumed by a rocket thruster controls the number of rounds a vehicle can use rockets to increase its speed or jump into the air while maintaining its current speed. Any rocket can act as a jump thruster or booster rocket.

Rocket thrusters as an auxiliary drive are not affected by a vehicle's Responsive or Unresponsive traits.

JUMP THRUSTER

A jump thruster is a short-burst rocket system designed to allow a vehicle to 'jump' 10 metres upwards for short distances at its current velocity. During a jump, for each additional round of rocket thrust the vehicle can either extend the jump or increase its jump height by 10 metres (the Referee can adjust this based on a world's gravity or other factors) but above the first 10 metres the vehicle must use another round of thrust to descend 10 metres or risk a crash, avoidable by a Difficult (10)+ operator check using DEX as a modifier and with DM-1 per 10 metres of altitude falling while not under rocket power.



BOOSTER ROCKET

With a booster rocket, the vehicle can exceed its rated maximum Speed Band by one, but if a vehicle is not capable of reaching at least Supersonic speed, it will suffer a loss of control when reaching Supersonic, only recoverable by a Very Difficult (12+) operator check, using DEX or INT as a modifier.

A rocket can also increase the speed of a vehicle to the point where it reaches orbital velocity around a planet or travels in a ballistic path to a distant destination. Reaching Orbital Speed and the effects of re-entry are covered on page 18. A rocket is assumed to be above the atmosphere once it has reached Hypersonic speeds.

The base vehicle for a rocket can be a structure with the Streamlined feature, basically a rocket body with the payload or upper stage carried as several Spaces of cargo. This has a large advantage in terms of a structure's extra Space capacity gained for not requiring any primary locomotion or power (a rocket stage is assumed to be powered by the rocket engine while in flight). A lower stage could also be an aeroplane capable of slower speeds and then launching a separate structure with a rocket body, which will then accelerate further to reach suborbital or orbital velocity.

If a vehicle's primary locomotion is capable of operating at the current Speed Band during rocket thrust, it may add its thrust to that of a rocket; allowing a vehicle to accelerate up to two Speed Bands up to Fast speeds and require only five rounds to pass through faster Speed Bands, essentially gaining the Responsive feature for the duration. In this case, an already Responsive vehicle can become doubly Responsive, allowing it to accelerate up to three Speed Bands in one round or needing only three rounds to pass through faster Speed Bands. Once the rocket reaches the vehicle's fastest Speed Band, this effect is no longer additive.

A rocket cannot be used to slow a vehicle unless it is intentionally designed as a forward-facing braking rocket or is used outside an atmosphere.

Instead of aiming for orbit, a rocket can launch on a ballistic path. Once it reaches Hypersonic speeds, it has travelled 100 kilometres and can travel horizontally for 200 kilometres per additional round of thrust before returning to the ground. If it has enough thrust to reach Orbital Speed, it can reach any point on the planet.

Booster Rocket

Rocket	TL	Spaces per Round of Thrust*	Cost per Space
Basic	5	4% of Vehicle Spaces	Cr10000
Improved	6	3% of Vehicle Spaces	Cr15000
Enhanced	7	2% of Vehicle Spaces	Cr20000
Advanced	8	1.2% of Vehicle Spaces	Cr30000

* Rockets consume a minimum of one Space

ARMOUR

Civilian vehicles rarely have more than the basic protection offered by the materials of their Tech Level but vehicles designed to endure wilderness, hostile or battlefield conditions allocate Spaces to protection. As technology advances, the materials used to construct and protect a vehicle become more sophisticated and resilient.

The base and maximum amount of armour on a vehicle is dependent on its Tech Level. The Vehicle Armour table shows the base protection available to all vehicles at each Tech Level.

The Maximum Protection value is the total amount of armour, including Base Protection, that can be applied to a vehicle. If the vehicle has the AFV trait, the Maximum Protection value is tripled. Base protection does not use Spaces and has no Cost, although additional armour does. The Spaces consumed by Armour are rounded up. When the amount of armour results in a partial Space used, the full Space is still consumed but the Cost of the armour can use the Cost per Point per Vehicle Space column instead of the Cost per Armour Space.

VEHICLE SIDES AND FACES

A vehicle has six sides or 'faces'. To prevent confusion over which face is which, the *Vehicle Handbook* borrows designations from maritime terminology. Front becomes *forward*, rear becomes *aft*, the sides are *port* (left when facing forward) and *starboard* (right when facing forward), the top of the vehicle is its *dorsal* face and its bottom is its *ventral* face.

Changing the armour allocation of different faces of a vehicle can allow one or more faces to exceed this level but except for the dorsal face of open-topped vehicles, the armour protection of any face cannot be lower than the vehicle's Base Protection level.

Vehicle Armour

TL	Materials	Base Protection	Maximum Protection	Vehicle Spaces per Point*	Cost per Armour Space	Cost per Point per Vehicle Space*
0–2	Wood, Bone, etc.	+0	+10	2.50%	Cr1000	Cr25
3–4	Iron	+1	+15	1.50%	Cr5000	Cr75
5–6	Steel	+2	+20	1.00%	Cr7500	Cr75
7–9	Alloys, Composites	+3	+30	1.00%	Cr12500	Cr125
10–11	Crystaliron	+5	+40	0.50%	Cr50000	Cr250
12–13	Superdense	+6	+50	0.40%	Cr75000	Cr300
14–15	Bonded Superdense	+8	+60	0.32%	Cr125000	Cr400
16	Molecular Bonded	+10	+80	0.20%	Cr375000	Cr750
17	Coherent Superdense	+15	+100	0.16%	Cr500000	Cr800
18+	Collapsium	+20	+160	0.10%	MCr1	Cr1000

* Vehicle Spaces per point are also related to Vehicle size, with small vehicles requiring more volume to cover their surface area than larger vehicles. See the Vehicle Size table on page 26.

ARMOUR ALLOCATION

The default allocation of overall added vehicle armour assumes a uniform application to a vehicle's forward, aft, starboard and port faces but with half that level applied to the dorsal and ventral faces.

> *For example, a TL10 vehicle (base Protection +5) with +10 points of additional armour applied will have Protection +15 applied to the forward, aft, port and starboard faces, and Protection +10 applied to the dorsalw and ventral faces. On a 30 Space vehicle, these 10 points of armour will consume (0.5%×10×30) 1.5 Spaces, rounded up to 2 Spaces.*

It is common, especially on military vehicles, to increase armour on one face at the expense of another. The result is that the vehicle is more resilient to attacks coming from a specific direction but it avoids the expense and weight of excess armour across all faces. Armour can be reallocated from any of the six faces to another on a point-by-point basis. In practice, starboard and port armour are generally kept identical, so reducing one point of armour from each of these will grant two points to be allocated elsewhere.

In all cases, small arms fire is reduced by both the armour and Tech Level of the vehicle and the Tech Level bonus protection applies as long as the face is not reduced below the base Protection for that Tech Level, as in an open-topped vehicle.

HULL MODIFICATION

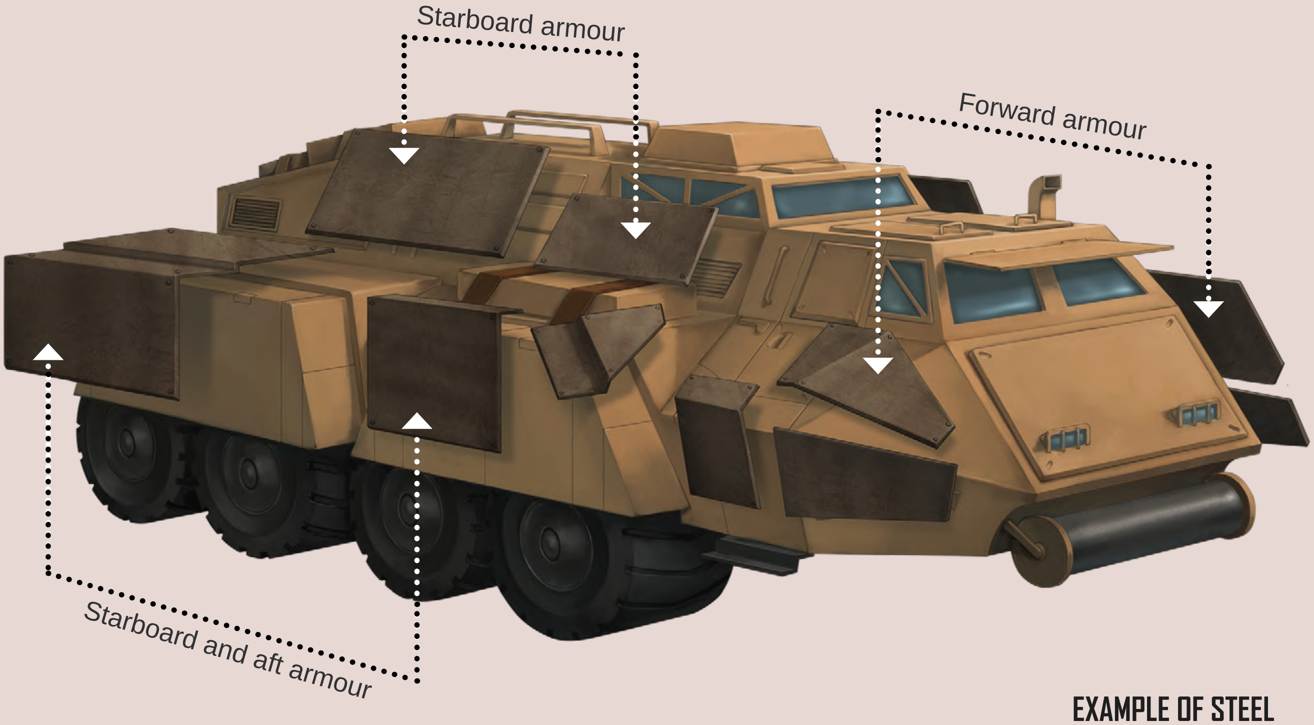
In addition to armour, a vehicle's hull can be strengthened by the use of high-quality materials or advanced construction methods to become tougher and more resilient to damage.

A reinforced hull always increases a vehicle's Hull by at least +1. A light hull will always decrease a vehicle's Hull by at least -1.

A one Space vehicle can have neither reinforced nor light hull modifications.

Structural Reinforcement

Structural Reinforcement	Hull	Cost
Reinforced Hull	+10%	+50%
Light Hull	-25%	-25%



EXAMPLE OF STEEL ARMOUR ALLOCATION

OPTIONS

A vehicle can have many options. All moving vehicles require at least some sort of control system, even if it is primitive. Options that interact with the environment are normally assumed to have some mounting on the outer surface of a vehicle but nothing prevents a large vehicle from having, for example, manipulator arms inside its chassis.

POWER REQUIREMENTS

Some options require power, which means the vehicle must have a power source or be able to accept grid or beamed power. Wind and muscle power are not sufficient to operate these devices. The option's description specifies any such requirements.

PROTOTYPE AND ADVANCED OPTIONS

Some items, such as transceivers and computers, become cheaper and lighter, while remaining as capable or better as Tech Levels increase. These follow a general progression, beginning with experimental or early prototype versions and progressing to basic versions and then, as Tech Levels increase, to ever more sophisticated versions until the item is supplanted by some higher technology alternative performing the same function.

Not all items have a long Tech Level range. For instance, the telegraph might be invented at TL3 but is nearly completely supplanted by telephone or radio by TL5. See the Tech Level Stages table for the complete range. In the *Vehicle Handbook*, only computers and transceivers follow this progression, although just about any item can use the Prototype and Early Prototype modifications if those constructing such items are aware of the function and scientific principles behind them.

Tech Level Stages

Tech Stage	TL	Cost (typical)
Early Prototype	-2	+1000%
Prototype	-1	+500%
Basic	+0	—
Improved	+1 interval	-50%
Enhanced	+2 intervals	-75%
Advanced	+3 intervals	-90%
Superior	+4 intervals	-95%

Early Prototypes require twice as many Spaces as the Basic version of an item. If an item does not normally consume Spaces, an Early Prototype consumes two Spaces and a Prototype consumes one Space.

STANDARD DEVELOPMENT STAGES VERSUS NEW TECHNOLOGIES

Most options do not follow a staged Tech Level approach, despite them being labelled as Basic, Advanced or some other modifier. Options such as sensors or navigation systems represent different technologies at different Tech Levels. As such, the higher tech options are often more expensive and/or larger than the Basic version but also more capable. While a TL12 version of a TL3 device can be constructed, if using the same methods as the TL3 device to achieve the same results, it will be a facsimile copy of an earlier device, the same in function and in size, and possibly much more expensive than the original.

CORE OPTIONS

All vehicles except structures require a control system option and certain other options are important to determine early in the design process because their abilities directly impact vehicle performance. These are also listed separately on the vehicle display sheet (see page 185). These options are Autopilot, Communications, Navigation, Sensors, Camouflage and Stealth. No vehicle is required to include any of these options, and some vehicles might be equipped with multiple versions, but the version of the option with the best bonuses should be determined first and listed in its section of the sheet.

CONTROL SYSTEMS

More sophisticated control systems can be installed within a vehicle to increase its effective Agility. This is usually achieved using technologies such as drive-by-wire or drive-by-light systems, heads up displays, physical links that can translate body movements – or even thoughts – into commands. Control system enhancements are additive with the agility feature, if present, but are a fixed Cost item, working regardless of a vehicle's size.

Note that Primitive control systems actually reduce a vehicle's total Cost, while Basic control systems are assumed to be automatically included in every vehicle unless another option is chosen.

Control Systems

Control System	TL	Agility	Cost
Primitive	1	-1	-Cr25
Basic	0	+0	Cr0
Improved	7	+1	Cr5000
Enhanced	10	+2	Cr15000
Advanced	12	+3	Cr25000
Superior	15	+4	Cr100000

Any control system that provides a positive Agility DM requires a powered vehicle.

AUTOPILOT

An autopilot is a device that, at its simplest, holds a vehicle to a set heading and speed. More sophisticated autopilots can operate a vehicle at least as well as a Traveller. Early autopilots are only of use on aircraft and waterborne vessels but, from TL9 onwards, they become effective for any vehicle and will automatically connect and coordinate with compatible local traffic control systems.

Prior to TL9, autopilots can perform all routine actions but do not handle unexpected conditions well and suffer DM-4 for any task that is Average (8+) or more complicated. Autopilots at TL9+ are fully capable of piloting a vehicle at the indicated skill level and can perform combat actions such as dogfighting and evading but have no tactical sense, so must be instructed by a remote operator, vehicle occupant or robot brain.

Autopilot

Autopilot	TL	Skill Level	Cost
Basic	5	0	Cr2000
Improved	7	1	Cr7500
Enhanced	9	2	Cr10000
Advanced	11	3	Cr15000
Superior	14	4	Cr60000

An autopilot requires a powered vehicle.

COMMUNICATIONS

A functioning communications system allows a vehicle to communicate with the outside world, potentially linking it to a planetary-wide network that can greatly increase its effective range. Vehicles in urban or densely populated areas of TL7 or greater worlds are often able to connect to the local communications network with a five-kilometre-ranged radio transceiver and these low-powered transceivers can receive messages from regional radio transmitters to a much greater distance, limited by local geography and atmospheric conditions more than by range. A transceiver with at least a 500-kilometre range and a satellite uplink can connect to a spacecraft or orbiting satellites at up to geosynchronous orbital altitude.

All communication systems require a powered vehicle but require no Spaces.

Transceivers

Transceiver Range	TL	Cost
5km	5	Cr200
50km	5	Cr600
500km	6	Cr600
5,000km	6	Cr3000
50,000km	7	Cr50000
500,000km	9	Cr50000

Transceivers can have additional options to increase functionality, as shown on the Transceiver Options table, and do not change size or Cost with Tech Level. Encryption algorithms are the best available at the installed Tech Level.

ENCRYPTION: While most signals are encrypted by default at TL8 or greater, an encryption module allows government-grade hardware encryption of secure communications, which ensures end-to-end encryption of the entire communications process when all parties are equipped with an encryption module. A message encrypted with this option is effectively impossible to decrypt at a lower Tech Level.

SATELLITE UPLINK: This system includes tracking systems, servos and antennae to maintain a link to a satellite or spacecraft in orbit and can maintain communications while both parties are moving, as long as the uplink has line of sight to the target. A satellite uplink requires at least a 500 km range transceiver.

TIGHTBEAM: This option adds a separate mode for transmitting and receiving, utilising lasers or masers instead of radio to provide point-to-point communications. This requires line of sight to the target but is nearly impossible to intercept.

Transceiver Options

Option	TL	Spaces Consumed	Cost
Encryption	6	0	Cr4000
Satellite Uplink	6	1*	Cr1000
Tightbeam	8	0	Cr2000

* At introduction. A satellite uplink consumes no Spaces at TL8 or higher.

MESON COMMUNICATORS

A meson communications system can transmit a message to a target, even through solid metal, using exotic particles that cannot be jammed and are only blocked by a meson screen. By default, meson transmissions are fully encrypted tightbeam links that use the equivalent of a satellite uplink and do not need or benefit from these additional options. The initiating party must be aware of the location of the target receiver.

All meson communicators require a powered vehicle and consume two Spaces, with Prototype and Early Prototype communicators requiring 10 or 20 Spaces, respectively.

Meson Communicators

Meson Comm Range	TL	Spaces Consumed	Cost
5,000km	12	2	Cr50000
50,000km	12	2	Cr100000
500,000km	12	2	Cr200000
5,000,000km	15	2	Cr500000

NAVIGATION

Navigation systems, fundamentally, allow the crew of a vehicle to know where they are and what direction they need to go in. At their most basic, navigation systems may provide simple readings based on altitude and magnetic compasses but rapidly expand into fully functional devices that draw information from installed databases, satellite transmissions and the vehicle's own sensors to completely map out their immediate environment. The Navigation Systems table shows the range available, along with the DM they provide to Navigation checks. All navigation systems beyond Basic require a powered vehicle.

Navigation Systems

Navigation Systems	TL	Navigation DM	Cost
Basic	5	+1	Cr2000
Improved	9	+2	Cr10000
Enhanced	11	+3	Cr25000
Advanced	13	+4	Cr50000

SENSORS

Early vehicles rely on a Traveller's own eyes and ears to detect objects in their vicinity, perhaps aided by a clear windscreen and headlights. As technology progresses, autopilot systems add short-range sensors to detect

Sensor Systems

Sensor Systems	TL	Range (km)	Electronics (sensors) DM	Cost
Basic	5	1	+0	Cr2000
Improved	7	5	+1	Cr15000
Enhanced	11	15	+2	Cr25000
Advanced	13	25	+3	Cr50000
Superior	16	50	+4	Cr100000

conditions and vehicles in the vicinity but these have very limited range and assume other vehicles are either actively cooperating with, or at least not trying to avoid, the vehicle's sensor net. To allow greater range and proactive measures to detect other vehicles and objects, a dedicated sensor system is required.

The composition of sensors change with Tech Level from simple radar and infrared sensors to sophisticated multispectral sensors and densitometers. The sensors here assume a package of active and passive devices appropriate for their Tech Level. See Sensors and Detection beginning on page 12 for information on their operation. All sensor systems and their customisations require a powered vehicle.

Sensor systems can have the following customisations added.

HARDENED (TL7): Sensor systems capable of burning through jamming and disruption can be installed into a vehicle. These systems ignore DM-1 of any penalty applied to them from jamming. This will double their initial Cost.

HIGH FIDELITY (TL6): More sensitive sensor systems can be installed, making detection of objects more likely. A high-fidelity system grants DM+1 to Electronics (sensors) checks. The sensor system will double its initial cost and consume one Space.

INCREASED RANGE: Every time the range of a sensor system is multiplied by 10, its initial Cost will be doubled. This can be done up to three times.

SENSOR MAST: A sensor mast allows a vehicle to use its sensors from behind cover so only the mast is visible, allowing the vehicle itself to remain hidden and out of direct line of sight. This is achieved using physical masts, floating balloons, buoys or tethered grav platforms. A sensor mast doubles the initial Cost of a sensor system and consumes one Space.

UNDERWATER SENSORS: A sensor system can be built for underwater use. A sensor system cannot be used for both below and above water, and vehicles wishing to have both capabilities must have two separate systems. Underwater sensors have their range halved and initial Cost doubled but can include other customisations.

CAMOUFLAGE

Camouflage is designed to hide a vehicle from visual detection, usually by using colour schemes that blend into specific environments or by breaking up a vehicle's outline. Camouflage has a minimum range at which it will work and lower Tech Levels rely on static colours and materials to achieve an effect, rendering camouflage ineffective in inappropriate terrain; camouflage patterned for a pink forest environment will not work on a rocky asteroid.

Camouflage focuses on the human (or other sophont) visual spectrum at lower Tech Levels, expanding into infrared, ultraviolet and beyond as Tech Levels improve. Generally, it is only applied against Recon checks, although sensors that specifically use visual means of detection (including infrared) might be affected at the Referee's discretion.

Advanced TL12 camouflage is an adaptive multi-chromatic coating that conforms to all terrains. It can also be used to project full-motion 2D video across the vehicle's hull for styling or advertising purposes and is common on high-technology luxury models. Despite not being intended for camouflage, a simple set of templates added to the design interface can transform the flashing exterior into shifting advanced camouflage patterns. Superior TL13 camouflage uses vislight technology to actively bend light around the vehicle with metamaterials and fibre-optic emitters, rendering it nearly invisible.

The basic Cost of any camouflage system is multiplied by the number of Spaces a vehicle has, although it consumes no Spaces itself.

Camouflage

Camouflage	TL	Detection DM	Minimum Range	Properties	Cost per vehicle Space
Primitive	1	-1	1 kilometre	Visual	Cr25
Basic	4	-2	500 metres	Visual	Cr100
Improved	7	-2	200 metres	Visual, IR	Cr500
Enhanced	11	-3	100 metres	Full spectrum	Cr2500
Advanced	12	-4	50 metres	Multi-chromatic	Cr10000
Superior	13	-4	20 metres	Vislight	Cr50000
Active*	15	-6	0 metres	Invisible	Cr200000

* The electronics required to control and power active camouflage consumes 5% of a vehicle's Spaces, rounding up.

At TL15, going beyond the light-bending properties of vislight camouflage, an active camouflage surface uses quantum waveguides to bend light, making the vehicle practically invisible across the entire electromagnetic spectrum, inflicting DM-6 to both Recon and Electronics (sensors) checks to find it.

Advanced, superior and active camouflage all require a powered vehicle.

HOLOGRAPHIC HULL

While not necessarily camouflage, a holographic hull adds full 3D motion images surrounding the vehicle and can provide better camouflage protection than vislight camouflage at a lower Tech Level (although at a much higher Cost). A full holographic hull requires so much power to maintain the illusion that only vehicles with nuclear power plants can power it for any length of time. Holographic hull emitters and sensors preclude the installation of any other form of camouflage or Reflec armour but do not consume any Spaces. A holographic hull requires 1 Power for every four vehicle Spaces.

REFLEC

Reflec is not camouflage; it is a surface coating providing an additional Protection +20 against laser weapons and has the disadvantage of not allowing any camouflage option to be installed on the vehicle, including a holographic hull. It actually makes the vehicle more visible under many conditions.

STEALTH

While camouflage helps a vehicle hide from visual detection, stealth allows it to evade detection by advanced sensors. As the Tech Level of conflict increases, stealth becomes more important than camouflage – in short, camouflage will not help hide a vehicle from radar or more advanced sensors, while stealth will not hide a vehicle from visual detection. Stealth is achieved through passive means, mainly by using advanced materials and design, and cannot be used at the same time as electronic countermeasures (see page 75).

Stealth applies a negative DM to Electronics (sensors) checks equal to the difference between the vehicle's TL and that of the device it is trying to evade. See Sensors and Detection on page 12 for a more complete explanation of the abilities and limitations of stealth.

The basic cost of stealth is multiplied by the number of Spaces a vehicle has, although it consumes no Spaces itself.

Stealth

Stealth	TL	Electronics (sensors) DM	Cost per vehicle Space
Basic	7	-1	Cr5000
Improved	9	-2	Cr10000
Enhanced	11	-3	Cr15000
Advanced	13	-4	Cr20000

	TL	Detection DM	Minimum Range	Properties	Cost per vehicle Space
Holographic Hull	10	-5	1 metre	Full spectrum holographic	Cr50000

	TL	Detection DM	Minimum Range	Protection	Cost per vehicle Space
Reflec	10	+1	Doubles detection range	+20 vs. lasers	Cr25000

EXTERNAL OPTIONS

Many available options are located on a vehicle's surface, including environmental protective measures, locomotion enhancements, connectors, various utility items and active defence mechanisms.

ENVIRONMENTAL HULL PROTECTION

While many vehicles are designed for everyday civilian use on temperate worlds, others must cope with truly hostile environments on planets where the atmosphere can corrode a vehicle into a hunk of rusted metal within days or hours.

Many options require life support (see page 80) for extended periods. This requirement is included in their descriptions. If life support is not present or is not functioning, the crew inside even a protected hull can survive for no more than a number of hours equal to half the vehicle's Tech Level, rounded down before suffering the effects of suffocation (see page 82 of the *Traveller Core Rulebook*).

The hull of a vehicle must provide a sealed environment to protect internal components and occupants. An Open-Topped vehicle is not able to install hull protection options. An Open Vehicle can install such protections but will only protect the vehicle, not its external occupants.

AQUATIC INTERNAL ENVIRONMENT

This vehicle is modified to support aquatic internal occupants. All interior surfaces and electronics are water-proofed and the vehicle is strengthened to hold the pressure and extra mass of a water-filled interior. This assumes a habitable external environment to allow oxygen (or other gas for exotic atmosphere sophonts) exchange and does not provide hostile environment protection or life support.

CORROSIVE ENVIRONMENT PROTECTION

The vehicle uses ceramic and corrosive atmosphere-resistant materials. It includes all the benefits of the hostile environment protection option but must be combined with life support to accommodate a crew.

HEAT SHIELDING

A vehicle with this protection can withstand the extreme heat on the surfaces of some worlds or an atmospheric re-entry from orbital velocity. From TL6–11, heat shielding provides protection from temperatures of up to TL×200 + 1,300°C. At TL12+, superdense material allows for greater protection equal to TL×500°C, or 6,000°C at TL12 and 7,500°C at TL15. Advanced molecular bonded heat shielding is available at TL16, protecting against TL×1,000°C and allowing vehicles to penetrate the surface of most stars. Improved and Advanced heat shielding requires a powered vehicle to distribute and mitigate the heat and will fail with 2D minutes without power.

HIGH PRESSURE PROTECTION

Some environments combine hostile, corrosive or insidious effects with extreme pressure, requiring a thicker hull and interior bracing to avoid crumpling. This type of construction is inherent in submersibles but other vehicles require one application of pressure protection to survive each additional 100 metres of water depth or 10 atmospheres of pressure. High-pressure protection includes hostile environment protection but must be combined with life support to accommodate a crew.

HOSTILE ENVIRONMENT PROTECTION

This is the most basic environmental protection and underlies many other hull protections. It is a series of modifications that safeguards both vehicle and crew in dangerous environments by providing a completely sealed interior. This includes protection against both heat and cold to ±250°C, radiation protection to 500 rads, water to 100 metres depth under standard pressure and against most poisons and bacterial threats.

Pressure protection provided by hostile environment is the equivalent of 10 bars, or 10 standard atmospheres. Submersibles (see page 23) have hostile environment protection by default and superior pressure protection as indicated in their description. For all other vehicles, additional high-pressure protection is available separately. Hostile environment protection provides the first level of pressurised hull protection but does not protect against a trace or vacuum atmosphere and must be combined with life support to accommodate a crew.

INSIDIOUS ENVIRONMENT PROTECTION

Some atmospheres are so destructive that they will eventually breach any defence, no matter how sophisticated it is. This option is not a permanent solution but provides protection against such environments for a number of days equal to the Tech Level of the vehicle. After this time has elapsed, the vehicle loses its protection against insidious environments, rendering it inoperative until completely refurbished, a process that takes 1D days in a fully-equipped workshop, costing 5% of the total value of the vehicle.

It includes all the benefits of hostile environment protection and must be combined with life support to accommodate a crew.

PRESSURISED HULL

This level of protection is insufficient for Vacuum or Trace atmosphere environments but allows a vehicle to maintain a breathable atmosphere in Very Thin atmospheres, or to an altitude of about 20 kilometres under Earth-like conditions. It provides no protection against radiation or overtly hostile environments but protects against most forms of tainted atmosphere and temperatures ranging between ±100°C. A second application of the option maintains pressure against Trace atmospheres and allows flights of up to 60 kilometres above the surface of an Earth-like world. A pressurised hull provides life support for occupants of any powered vehicle for the duration of its flight but without power, conditions will deteriorate to unbreathable levels within a number of hours equal to the Tech Level of the vehicle, divided by two and rounding down.

RADIATION PROTECTION

Radiation protection adds layers of materials to stop or absorb most forms of radiation with increasing effectiveness as technology improves. It requires hostile environment protection to be effective and does not provide any life support functions. It adds TL×50 rads to the 500 rads of protection offered by hostile environment protection. Radiation protection also applies a 'hardened' modification to all a vehicle's electronic components, protecting them from electromagnetic pulses and ion weapons.

SELF-CLEANING HULL

This vehicle surface coating resists stains and dirt, cleaning itself automatically. It sloughs off dirt, dust and mud (although this can be suspended for the purposes of camouflage).

SELF-REPAIRING HULL

In addition to the features of a self-sealing hull, the self-repairing hull automatically reduces the Severity of one Critical Hit to the Hull location by -1 every day.

Environmental Hull Protection

Protection	TL	Effect	Spaces	Cost per vehicle Space
Aquatic Internal Environment‡	6	Water-filled, supports aquatic occupants	—	Cr1000
Corrosive Environment‡	9	Atmosphere B	—	Cr5000
Heat Shielding (basic)	6	Protects to TL×200+1,300°C	—	Cr25000
Heat Shielding (improved)	12	Protects to TL×500°C	—	Cr100000
Heat Shielding (advanced)	16	Protects to TL×1,000°C	—	Cr500000
High Pressure‡	7	+10 atmospheres pressure protection	0.5%*	Cr1500
Hostile Environment	6	Atmospheres 2–A, 500 rads, water to 100m	—	Cr1000
Insidious Environment‡	11	Atmosphere C+	—	Cr25000
Pressurised Hull	5	Protects against Very Thin and Tainted atmospheres	—	Cr200
Radiation	7	+50 rads per TL	5%†	Cr5000
Self-Cleaning Hull	10	Resists mud and dirt, automatic cleaning	—	Cr2000
Self-Repairing Hull	12	Repairs 1 Hull point per day	5%†	Cr50000
Self-Sealing Hull	11	Seals hull breaches, includes self-cleaning	—	Cr5000
Vacuum Environment‡	6	Atmospheres 0–1	—	Cr2000

* Consumes a minimum of one Space per application.
† Consume a minimum of one Space.
‡ Includes hostile environment protection.

However, it can repair a shattered hull, or any damage once a vehicle's Structure is exceeded 10 times. Self-repairing hulls require a powered vehicle.

SELF-SEALING HULL

Minor hull breaches and scratches are repairable by smart materials located between layers of hull surfaces. It can close a Severity 1 Critical Hit to the Hull within 1D rounds. A self-sealing hull includes the features of a self-cleaning hull and the benefits of a self-sealing fuel tank (see page 89) without consuming Spaces.

VACUUM ENVIRONMENT PROTECTION

This seals the vehicle against Vacuum and Trace atmospheres. Vacuum environment protection requires a powered vehicle and must be combined with life support to accommodate a crew but includes all the benefits of hostile environment protection.

CONNECTORS

Vehicles can be connected to one another in several ways, ranging from a simple tow hitch to a large docking clamp. The Towing section on page 23 describe the limitations and effects of towing. Additionally, airlocks (page 78) can serve as docking hatches and vestibule couplers between vehicles.

COUPLER

A coupler is a compatible connector between one vehicle and another. A vestibule coupler can connect to a compatible vestibule coupler and maintain whatever environmental protections are available in both vehicles. It can expand about one metre to allow two vehicles to connect. It can maintain a connection between two moving vehicles on a track or smooth flat surface but to maintain a solid connection that supports any sort of environmental protection over movement off-road, or on water or air, docking clamps and hatches are necessary.

Coupler	TL	Effect	Spaces	Cost
Simple Coupler	2	Links to a coupler-equipped vehicle	0	Cr100
Vestibule Coupler	3	Link that maintains environment	1	Cr500

Docking Clamp	TL	Effect	Spaces	Cost
Type 0	4	Connects a vehicle of up to 20 Spaces	1	Cr50000
Type I	4	Connects a vehicle of 21–120 Spaces	4	Cr500000
Type II	4	Connects a vehicle of 121–400 Spaces	20	MCr1
Type III	4	Connects a vehicle of 401–1,200 Spaces	40	MCr2
Type IV	4	Connects a vehicle of 1,201–8,000 Spaces	80	MCr4
Type V	4	Connects a vehicle of 8,001 or more Spaces	200	MCr8

DOCKING CLAMP

A docking clamp allows a vehicle to carry another vehicle on the exterior of its hull while the vehicles are in motion. It provides a solid link and includes a vestibule coupler that can align with a coupler or hatch on an attached vehicle. A docking clamp is rated by the Spaces it can support.

Vehicles connected by a docking clamp can be considered to be towed by one vehicle and are subject to towing restrictions. If both vehicles are in motion, they can remain connected and move at the rate of the slower vehicle. If a vehicle is connected to another via a docking clamp, neither can exceed Subsonic speeds while in an atmosphere and any bonus from the Streamlined feature is not applied.

DOCKING HATCH

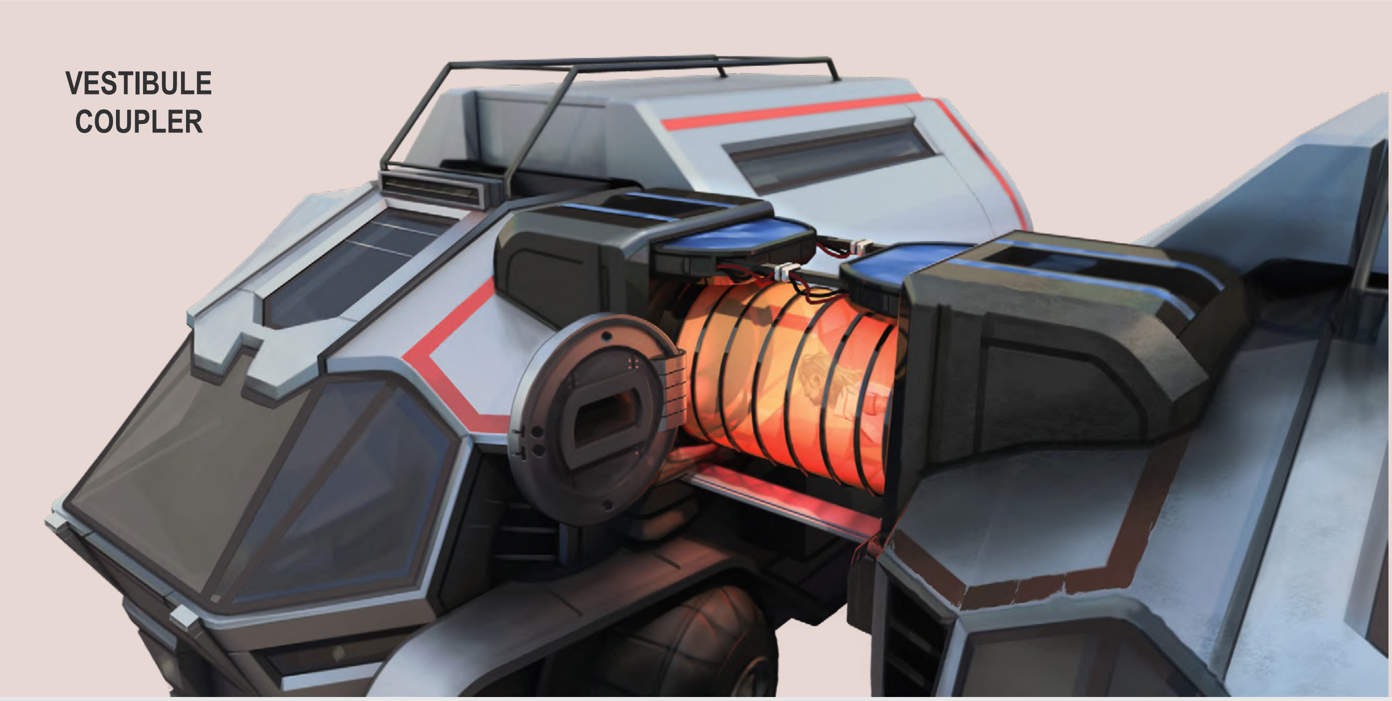
One docking hatch can act as a connector to another, or as an exit point from a vehicle, but it has no airlock or vestibule for expansion, requiring a tight lock between the two vehicles. Unless the linked vehicles are connected by a coupler or docking clamp, a connection between two hatches is not flexible enough to maintain the link between two moving vehicles.

	TL	Effect	Spaces	Cost
Docking Hatch	5	Airtight link between vehicles	0	Cr500

TOW HITCH

A tow hitch is a connector on the surface of one vehicle that allows it to connect to another for towing. The hitch consists of an attachment point, plus cabling and hooks to attach the hitch to another vehicle. The cost of a tow hitch is based on the number of Spaces of a powered vehicle it can tow; it can tow twice as many Spaces of an unpowered vehicle such as a cart, raft or trailer.

	TL	Cost per towed Space
Tow Hitch	1	Cr20



WINCH

A winch is an attachment with a 25-metre cable that acts as a tow hitch or, when powered, is able to pull another vehicle or object at up to the winch-equipped vehicle's size in Spaces (twice this if it is an unpowered or less dense object). A winch can be used to pull the vehicle forward if attached to a solid larger object, such as a building or sturdy tree. It is usually attached to the forward face of a vehicle but that is not a requirement. A vehicle can have no more than one winch attached to any one face.

	TL	Cost per vehicle Space
Winch	3	Cr50

CLIMBING WHEELS

An ATV or tracked vehicle can drive across steep terrain but to tackle extremely steep hills requires more wheels or treads capable of sticking to the terrain while still allowing the vehicle to move forward. A climbing wheel (or track) has adaptable adhesive material with spikes to adhere to a steep surface. At higher Tech Levels these wheels can allow vehicles to scale vertical surfaces, like cliffs or walls, or traverse the ceiling of a large open structure like a large dome or tunnel.

In addition to installation on wheels, this technology is available for tracked and walker vehicles. While climbing wheels are compatible with the smart wheels feature and the ATV, Off-Roader and Tracked traits, they do not provide any of these benefits on their own. Climbing wheels require a powered vehicle.

Climbing Wheels

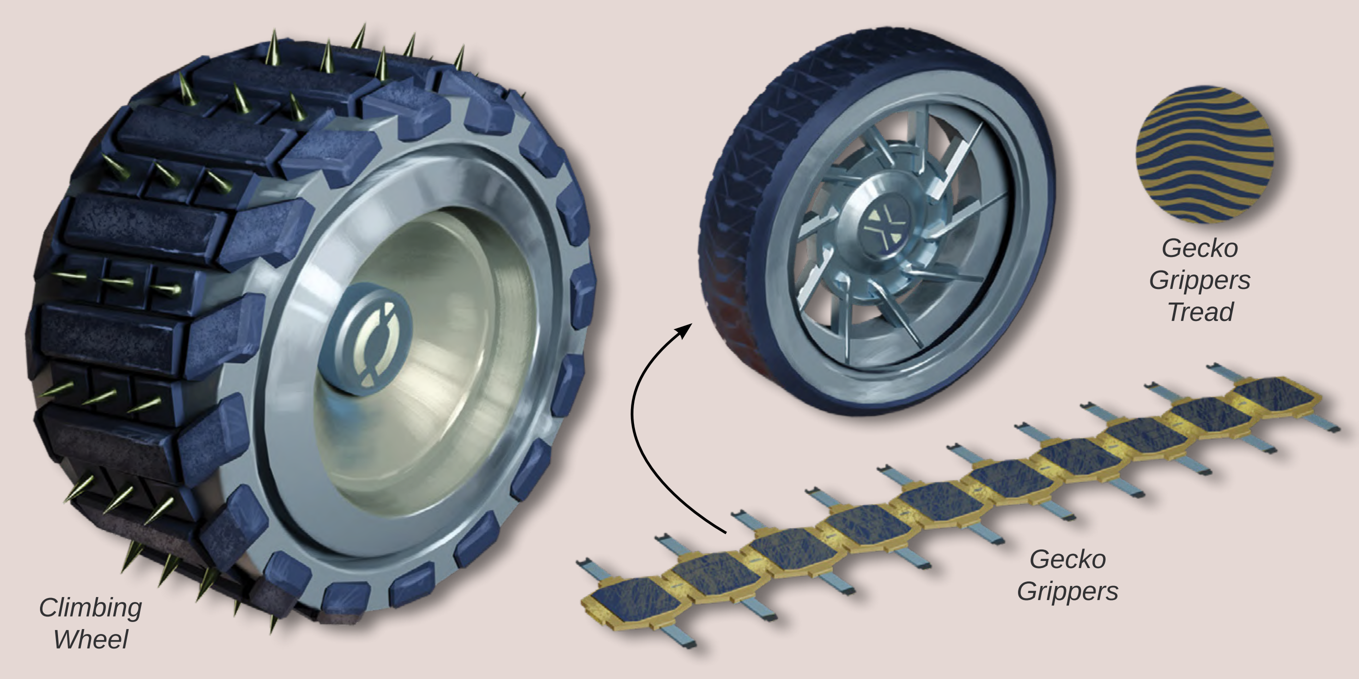
Climbing Wheel	TL	Maximum Grade	Cost per Vehicle Space
Basic	8	60%	Cr1000
Improved	10	80%	Cr2000
Enhanced	12	100%	Cr5000
Advanced	14	Any	Cr10000

GECKO GRIPPERS

The surfaces of a Small vehicle's tyres, tracks or legs can be covered in a material that uses the Van der Waals force to adhere the vehicle to walls and ceilings. A vehicle equipped with gecko grippers can climb vertical surfaces and ceilings of almost any material in gravity environments ranging from 0–1.5G. Movement is reduced to Idle while traversing these surfaces.

As a vehicle becomes larger, the ratio of surface area to volume decreases, so only a Small vehicle of 3 or fewer Spaces can use gecko grippers. They can only be applied to ground vehicles and walkers, although a Small structure or any Small vehicle could use the grippers to statically stick or park on a wall or ceiling.

	TL	Effect	Cost per Vehicle Space
Gecko Grippers	9	Small vehicles only	Cr25000



MANIPULATOR ARMS

A manipulator arm is a remote appendage, terminating in a claw or mechanical hand, varying greatly in size, strength and dexterity. Normally, a crewmember controls these arms using a waldo, although remote or robot control is also possible. All manipulator arms require a powered vehicle.

ROBOT-SIZED MANIPULATOR ARMS

Small vehicles may install robot arms created using the rules in the *Robot Handbook* (pages 25–28). Up to four robot manipulators can be installed using 1 Space. A Space one vehicle may install two Size 5 (or smaller) manipulators without using its only Space.

If desired, a vehicle larger than 3 Spaces could install additional robot arms, using one Space for every four arms.

MANIPULATOR ARM

In most cases, vehicles larger than three Spaces require longer reach and more internal space to support a 'shoulder' socket. These arms are listed in the Manipulator Arms table. The STR and DEX of manipulator arms can be increased by +1 for each doubling of the Cost, to a combined maximum of +5 at 32 times the listed Cost.

Manipulator Arms

Manipulator Arm	TL	STR	DEX	Spaces	Cost
Primitive	5	7	TL-3	1	Cr1000
Basic	7	12	TL-3	1	Cr2000
Improved	8	12	TL-2	1	Cr5000
Enhanced	9	15	TL-1	1	Cr10000
Advanced	10	18	TL	1	Cr15000

HEAVY MANIPULATOR ARMS

Large vehicles can install even larger arms, the equivalent of dexterous cranes or forklifts. These can individually pick up and hold objects up to 50% of the vehicle's Spaces (or 250 kilograms for every Space of the vehicle). For example, a 64-Space vehicle with two arms can use both arms to pick up one object of up to 64 Spaces or 32,000 kilograms. This increases by ½ Space (round down) and 250 kilograms for each Tech Level above 10.

The STR of a heavy manipulator arm is equal to the Tech Level plus the number of Spaces in the vehicle. As with smaller manipulator arms, STR and DEX can be increased by +1 for each doubling of the Cost of the manipulator arm to a combined maximum of +5. Each increase of STR also increases the carrying capacity of the arm by ½ Space and 250 kilograms. STR is also relevant when computing damage from a heavy manipulator arm attack. An arm inflicts damage equal to 2D+1D for every 10 STR, rounding up.

A vehicle with two or more heavy manipulator arms can theoretically use them to lift itself and climb a vertical surface, assuming there are handholds large enough to grab.

WEAPONS MOUNTS

Any manipulator arm can have an attached fixed weapon mount (see page 102). The firing arc of a manipulator arm is determined by the reach of the arm, which is normally 180°, although a top-mounted arm may have a full 360° arc of fire, and arms mounted on two-legged walkers may benefit from rotation of 'hips' to increase the firing arc.

Fixed mounts attached to manipulator arms have weapon size limits based on the size of the arm. Limits for robot arms are described in the *Robot Handbook* on page 61. Regular-sized manipulators are limited to weapons requiring one Space or massing less than 250 kilograms. A heavy manipulator arm can support weapons equal to 50% of its Spaces or up to 125 kilograms of weapons for every Space the arm consumes.

Heavy Manipulator Arms

Manipulator Arm	TL	DEX	Spaces*	Cost per Vehicle Space
Basic	7	TL-3	5%	Cr1000
Improved	8	TL-2	5%	Cr2000
Enhanced	9	TL-1	4%	Cr5000
Advanced	10	TL	3%	Cr10000

* Per arm. Each heavy manipulator arm consumes at least two Spaces.

EXTERNAL UTILITY

This section covers a variety of items installed on or attached to the surface of a vehicle.

CARGO MOUNT

An external rack or mount allows items to be carried without using interior Spaces. A vehicle can carry as much as 50% of its Spaces or the equivalent 250 kilograms increments in cargo mounts but placing non-streamlined items on the outside negates the benefit of being streamlined and prevents an aircraft (and grav vehicles) from flying faster than Very Fast in an atmosphere. A vehicle can carry additional external cargo, up to its entire number of Spaces but at the cost of one Speed Band movement and with DM-1 for checks driving ground vehicles or walkers when operating off-road or in rough terrain. The Cost per Space is that of the cargo mount's capability and does not consume actual Spaces.

	TL	Cost per Space
Cargo Mount	1	Cr250

CRANE

A crane is a gantry that can be folded to lie flush in line with the vehicle's chassis or within it. Fitted with lifting equipment such as hooks or grabbers, cranes are used to move heavy loads within reach of the vehicle.

Cranes of different sizes become available at different Tech Levels but all cranes at TL5 and above require a powered vehicle. For every Tech Level after introduction, a crane can lift 10% more mass.

Crane	TL	Maximum Load	Spaces Consumed	Cost
Light	1	500kg	1	Cr1000
Medium	4	5 tons	5	Cr10000
Heavy	5	100 tons	40	Cr100000
Super Heavy	7	500 tons	100	MCr1

CONVERTIBLE

The convertible option allows a vehicle to temporarily gain the Open-Topped trait (see page 16) by removal of its top or dorsal face structure, either manually, or at TL7+, automatically. When the top is removed, the vehicle and occupants have the advantages and restrictions of a vehicle with the Open-Topped trait. This option cannot be applied to vehicles with the AFV feature and soft top convertibles cannot have environmental hull protection installed. A soft top may not have additional armour installed to the dorsal face and armour on the dorsal face is one half of the Tech Level's base armour Protection, rounded up. A hard top vehicle may have environmental hull protections and armour added but these are not effective when the top is down.

Manual convertibles require 1D minutes to open or close the top. An automatic convertible top requires five combat rounds (30 seconds) to open or close at TL7, reduced by 1 round per Tech Level, becoming essentially instantaneous at TL12+, although safety features will prevent it from snapping closed if obstructed. Any convertible option adds +1 to the effective SOC expressed by a luxury vehicle exterior (see page 70). Automatic convertibles require a powered vehicle.

Convertible	TL	Cost per Vehicle Space
Soft top (manual)	4	+20%
Soft top (automatic)	7	+30%
Hard top (manual)	5	+40%
Hard top (automatic)	7	+50%

CUTTING TOOL

The nature of a heavy-duty external cutting tool varies depending on the Tech Level and operating requirements of the vehicle, but the technology generally becomes more effective and better able to penetrate tough materials or armour at higher levels. The AP listed is a general description of what protection the cutting blade can 'ignore' but it can slice through tougher material given time. A vehicle-mounted cutting tool is much larger than personal-sized cutting tools and can cut faster. A cutting tool requires a powered vehicle.

Cutting Tool	TL	Cutting Blade	Cut Rate	Spaces	Cost
Basic	5	AP 5	10	5	Cr10000
Improved	10	AP 10	25	5	Cr25000
Enhanced	12	AP 20	50	5	Cr50000
Advanced	14	AP 40	100	5	Cr200000

DIGGER BLADE

A large external blade and scoop for excavating and clearing material, the digger blade can scale to 25% of a vehicle's Spaces and performs the labour of four standard-sized sophonts for every Space consumed by the blade. It can scoop 500 kilograms of material per Space. A digger blade requires a powered vehicle.

	TL	Cost per Space
Digger Blade	5	Cr2500

DRILL RIG

A drill rig is designed to cut a hole up to one metre wide into solid rock. The rig requires a stationary powered vehicle to operate and can only cut about five metres into a horizontal surface, but can cut a deep vertical shaft, with depth limited to its Tech Level × 1.5 in kilometres. It drills at the rate of 1–3 metres per hour, depending on the hardness of the material and width of the hole. Each doubling of the size of the hole will quadruple the size and Cost of the drill rig. Additional equipment may be required to remove material and keep the shaft open.

	TL	Spaces	Cost
Drill Rig	5	15	Cr100000

EXTERNAL SAMPLER

This is a system of collectors, pipes and filters used for sampling the external environment. A separate external sampler is required for gases, liquids and solids. An Electronics (sensors) or appropriate Science check is required to gain useful information. At higher Tech levels, the sampler requires less volume until it just becomes a replacement panel on the vehicle's hull. Samplers can provide specimens directly to an adjacent laboratory without coming into contact with the rest of the vehicle's interior. External samplers require a powered vehicle.

External Sampler	TL	Spaces	Cost
Basic	8	3	Cr10000
Improved	10	1	Cr15000
Advanced	12	0	Cr25000

GROUND PENETRATING RADAR

Vehicle-sized ground penetrating radar can locate items or anomalies buried in soil or loose rock. An item of any density or composition can be detected and identified by making an Average (8+) Electronics (sensors) check (INT or EDU, 1D rounds). Initial versions consist of a detector with two telescoping mounted arms connected to a control unit. The TL11 version deploys three dedicated grav-powered drones to allow for triangulation to improve accuracy and penetration depth, providing DM+2 to detection attempts. Solid rock or metal reduces the effectiveness of the radar by as much as 75%. Crystaliron, superdense and more advanced armour prevent all penetration by ground penetrating radar. Ground penetrating radar requires a powered vehicle.

LANDING DECK

A landing deck allows an aeroplane requiring a runway to land on another vehicle in a very short distance. The landing deck has arresting equipment to slow an aeroplane equipped with a tailhook from as much as High speed to a stop in one combat round. STOL aeroplanes do not require a tailhook but gain DM+2 to landing attempts on the deck. The landing deck consumes 10 times the Spaces of the largest vehicle it can accommodate. The aeroplane can exit the landing deck and allow another vehicle to land in 6+1D combat rounds.

Unless the aircraft has the VTOL feature, a successful landing on a landing deck requires an Average (8+) Flyer (wing) check (one round, DEX) under normal conditions, with marginal and average failures indicating an abort

Ground Penetrating Radar	TL	Effect	Spaces	Cost
Basic	7	Detects anomalies to 100 metres depth	2	Cr20000
Improved	9	Detects anomalies to 200 metres depth	1	Cr50000
Advanced	11	Detects anomalies to 500 metres depth, DM+2	1	Cr100000

Landing Deck	TL	Effect	Spaces	Cost per Space
Basic	6	Land an aeroplane every 6+1D rounds	10 per Vehicle Space landed	Cr20000 per Space
Improved	8			Cr30000 per Space
Advanced	12	Land an aeroplane every 3+D3 rounds		Cr50000 per Space

Tailhook	TL	Effect	Spaces	Cost per Space
Basic	6	Aeroplane option required for landing deck arrest	1 per 10 vehicle Spaces*	Cr25000 per Space
Advanced	10	Additional DM+2 to landing	—	Cr5000 per vehicle Space

* A basic tailhook consumes at least one Space.

and go-around or a hard landing (1D damage to the vehicle), respectively. An exceptional failure results in a collision at up to High speed or the aeroplane striking surrounding environment at the Referee's discretion. The Going Faster or Slower rule is not an option.

A landing deck requires a powered vehicle and crew of one per 50 landing deck Spaces. At TL8, the crew requirement is one per 100 landing deck Spaces and at TL12 the Launch Deck is fully automated, does not require aeroplanes to have a tailhook and all normal landing attempts become Easy (4+) Flyer (wing) checks.

LAUNCH DECK

A large vehicle can carry smaller vehicles and deploy them. Ground or water vehicles can deploy these smaller vehicles directly from a hangar or docking bay if the subordinate vehicle is capable of motion in the same environment (ground vehicles or walkers from a larger ground vehicle or walker, or a watercraft or hovercraft from the same). For aeroplanes needing a runway, this becomes more complicated. A launch deck provides an assist via a steam catapult, magnetic rail or other powered device to allow non-VTOL or STOL vehicles to launch from another vehicle.

Each launch deck consumes 10 Spaces for each vehicle Space it has the capacity to launch. A vehicle requires multiple combat rounds to be placed on a launch deck and readied for launch but needs only one round to be launched. At the end of the launch round, it is travelling at High speed or its cruising Speed Band, whichever is lower.

A launch deck requires a powered vehicle and crew of one per 50 launch deck Spaces while operating. At TL8, the crew requirement is one per 100 launch deck Spaces, and at TL10 the Launch Deck is fully automated.

LUXURY EXTERIOR

The exterior surface of a vehicle can have non-functional enhancements that affect styling and prestige. These options have no impact on functionality and only increase the Cost per Space but might make a vehicle more suitable to those who have, or aspire to, greater social status. Vehicles with a luxury exterior often have luxury interior space. Luxury exterior is rated by the SOC the vehicle intends to express and is priced at a percentage of base vehicle Space Cost.

Luxury Exterior SOC	Cost per Vehicle Space
8	+20%
9	+30%
10	+50%
11	+100%
12	+200%
13+	+500%

OUTBOARD MOTOR

An outboard motor can be fitted to a watercraft. Refuelling this motor requires a Space of auxiliary fuel tank for every 20 Spaces of the vehicle, rounded up.

Launch Deck	TL	Effect	Spaces	Cost per Space
Basic	6	Launch an aeroplane every 24+2D6 rounds	10 per vehicle Space launched	Cr20000
Improved	8			Cr30000
Advanced	10	Launch an aeroplane every 12+1D rounds		Cr50000

Outboard Motor	TL	Effect	Cost per Vehicle Space
Outboard motor (Idle)	3	Propels a watercraft at Idle Speed for TL×20km	Cr100
Outboard motor (Very Slow)	4	Propels a watercraft at Very Slow Speed for TL×20km	Cr250

Ram	TL	Effect	Spaces*	Cost per Vehicle Space
Ram	1	4D plus 1D per 50 Spaces ramming damage	5%	Cr100
Ram (metal-tipped)	1	4D, AP4 plus 1D and AP1 per 50 Spaces	5%	Cr200

* A ram consumes at least one Space.

Refuelling Plant	TL	Effect	Spaces*	Cost per Space consumed
Basic	9	Refuels a vehicle in 24 hours	5%	Cr15000
Advanced	12	Refuels a vehicle in 12 hours	4%	Cr20000

* Refuelling plants consume a minimum of five Spaces and include deployable solar panels.

RAM

A ram is a metal spike or wedge mounted on a vehicle, usually on the forward end of watercraft and below the waterline. It can also be used by ground vehicles or submersibles. Its purpose is to impact another vessel and puncture its hull, binding the vehicles together or, after pulling back, causing the target to sink from the ensuing hull damage. A ram does 3D damage, plus additional dice equal to the ramming vehicle's relative Speed Band times 1D per 50 vehicle Spaces (round up). Metal-tipped rams add AP equal to the number of dice of damage.

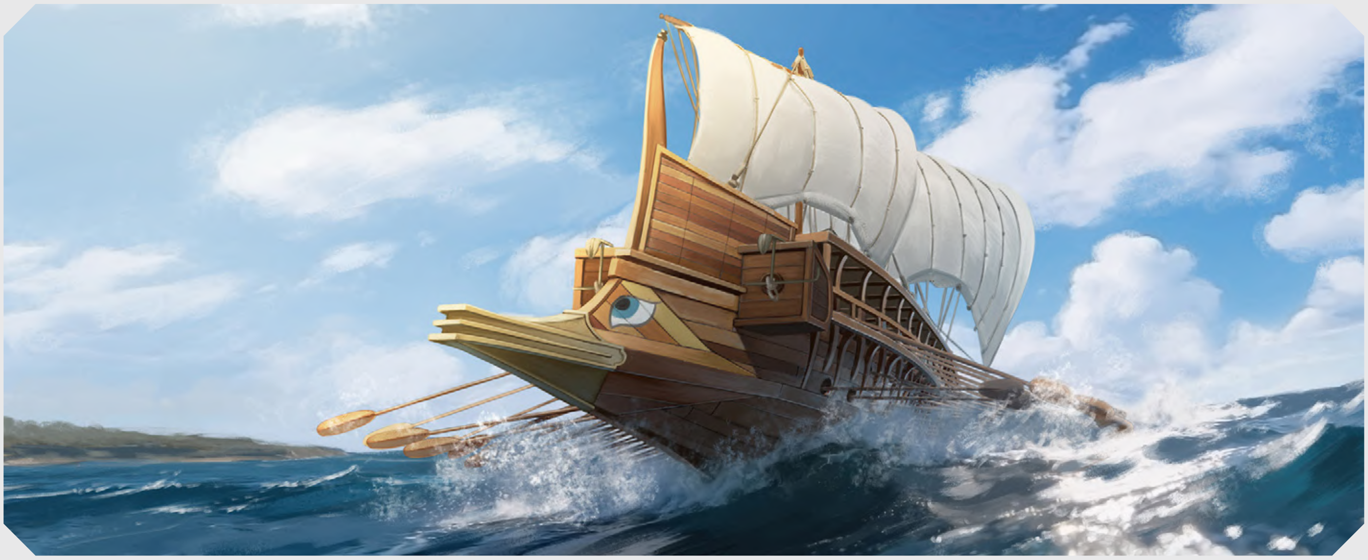
> *For example, a ram on a 30 Space vehicle travelling at Slow (3) speed would do 3D+3×1D or 6D damage with AP6 if metal tipped. On an 80 Space vehicle, the damage would be 3D+3×2D or 9D.*

REFUELLING PLANT

A refuelling plant can turn water into hydrogen fuel. It requires a significant amount of volume and access to both water and sun. At TL9, it requires 24 hours of sunlight to crack sufficient fuel to completely refuel the vehicle. At TL12 this is reduced by half.

A powered vehicle can run a refuelling plant to provide fuel for other vehicles of the same size and fuel system in the same time period, using either solar or its own internal power.

In either case, it requires access to as much water as the vehicle has Spaces, which might be trivial in a swamp but near impossible in a desert. Fusion+ does not require a refuelling plant since it refuels with water directly and uses its own power to provide hydrogen and expel oxygen as a byproduct, or channels it into a life support unit.



TYRE CHAINS

A wheeled vehicle can gain the Off-Roader trait by fitting chains around its tyres. This is normally done to travel over snow or ice but can also help with muddy ground. Tyre chains require a Routine (6+) Mechanic check (1D minutes, DEX) to install or remove, a task sometimes negatively affected by inclement weather. While installed, tyre chains reduce a vehicle's Speed Band by two and negate the advantage of smart wheels.

Tyre chains do not consume Spaces when installed but require a Space per 20 vehicle Spaces if stored as cargo (round down).

	TL	Effect	Cost per Vehicle Space
Tyre Chains	3	Off-Roader, Speed Band -2, negates Smart Wheels	Cr20

VEHICLE PARACHUTE

For use in an emergency when an aeroplane or other flying vehicle loses power and control, the vehicle parachute allows the vehicle to safely descend from the sky. A landing is generally uncontrolled and deployment of the parachute can damage the vehicle. At TL6 or below the vehicle must be at an altitude of at least 500 metres to fully open and slow the vehicle's descent; this decreases to 200 metres at TL7 and 100 metres at TL9. Vehicle chutes at TL10 use grav chutes to bring the vehicle to rest and can be deployed at any altitude. Only the grav chute version will work at supersonic or greater speeds but an intact vehicle falling in an atmosphere generally slows by one Speed Band per 1,000 metres of falling until reaching Fast speed; this can vary considerably with planetary atmospheric density and gravity.

Vehicle chutes are bulky and will not always fully protect the vehicle or its occupants. Landing via a parachute is always treated as an Idle speed collision, increased by one Speed Band for every 100 metres or fraction thereof below the parachute's safe deployment altitude. Passenger protective systems can limit the damage done to the occupants but not to the vehicle. In addition, the vehicle will suffer D3-1 Critical Hits upon impact and require at least 5% of its original cost to restore to flying condition, in addition to any damage caused by its landing.

A vehicle parachute does not require a powered vehicle but it must be fully replaced after use.

WHEEL TRACKS

A wheeled vehicle can gain the ATV trait by installing small tracks on its tyres. These require a Routine (6+) Mechanic check (1D x 10 minutes, DEX) to install or remove, a task sometimes negatively affected by inclement weather. Wheel tracks reduce a vehicle's Speed Band by two and negate the advantage of smart wheels but grant the terrain handling capabilities of a tracked ATV.

Wheel tracks do not consume Spaces when installed but require one Space per five vehicle Spaces if stored as cargo (round up).

Vehicle Parachute	TL	Effect	Spaces*	Cost per Vehicle Space
Basic	5	Fully deploys from 500 metres	5%	Cr500
Improved	7	Fully deploys from 200 metres	5%	Cr500
Enhanced	9	Fully deploys from 100 metres	5%	Cr1000
Advanced	10	Fully deploys from ground level	5%	Cr2000

* A vehicle parachute consumes at least one Space.

	TL	Effect	Cost per Vehicle Space
Wheel Tracks	5	ATV, Speed Band -2, negates Smart Wheels	Cr200

ACTIVE DEFENCE

Armour is the primary defence for many combat vehicles but there are a range of vehicle-protection options. This section also includes additional camouflage and sensor options.

ACOUSTIC CAMOUFLAGE

This is a specialised camouflage option designed to thwart acoustical (or auditory) sensors or Recon checks. It negates the bonuses of acoustic sensors and removes Recon advantages based on heightened hearing. Much like optical camouflage, it has a minimum range, within which it is ineffective. It has no effect in a vacuum environment and at TL8 and above, acoustic camouflage requires a powered vehicle.

ACOUSTIC SENSOR

An acoustic sensor is a passive listening device that strengthens, separates and analyses sound waves to locate and identify an object. This sensor works within an atmosphere or a liquid environment. Acoustic sensors are considered part of any standard underwater sensory suite; if the vehicle already has such a suite, the addition of this sensor provides DM+1 to detection attempts and only if the DM is better than the installed sensor, but its range underwater is 20 times its base range. The range of these sensors vary with atmospheric properties. They function at double range in a Dense or thicker atmosphere, half range in a Thin atmosphere and quarter range in a Very Thin atmosphere. Range is 10% in a Trace atmosphere and it does not function in a vacuum. Acoustic sensors require a powered vehicle.

ANTI-MISSILE SYSTEM

These automated systems are capable of tracking incoming missiles, artillery and grenades, then destroying them in mid-flight. This is typically done with very rapid-firing but small calibre miniguns, replaced by gauss or laser weapons as they become viable.

Anti-missile systems (AMS) automatically destroy an incoming solid projectile, including missiles, artillery shells or rocket-propelled grenades on a 2D roll of 8+, with a DM appropriate to their type shown on the Anti-Missile Systems table. A cumulative DM-1 is applied to every additional incoming attack made in the same round, so the first attempt will have no penalty, the second DM-1, the third DM-2 and so on. Anti-missile systems fire extremely rapidly and consume ammunition equal to 10 times their Auto trait every time they fire. An anti-missile system is a self-contained automated turret, with armour equal to the vehicle's most-heavily protected face. The system has its own optimised short-range sensors and fire control system.

Attempts to shoot down small arms fire from weapons that cause less than 1DD damage or without the Blast trait incur DM-4 before the advent of the advanced

Acoustic Camouflage	TL	Minimum Range	Detection DM	Notes	Cost per Vehicle Space
Basic	5	50 metres	-1	Coverings and dampers	Cr250
Improved	8	20 metres	-2	+Active sound dampening	Cr500
Enhanced	10	10 metres	-3	+Active sound projection	Cr2000
Advanced	12	1 metre	-4	+Active sound projection	Cr5000

Acoustic Sensor	TL	Base Range	Detection DM	Notes	Cost
Basic	5	5km	+1	Standard frequencies	Cr500
Improved	8	10km	+2	Broad frequences and analytics	Cr10000
Enhanced	10	100km	+3	Enhanced sensors and analytics	Cr50000
Advanced	12	1,000km	+4	Advanced sensors and analytics	Cr100000

Anti-Missile System	TL	Range (km)	Damage	Spaces	Cost	Magazine	Magazine Cost	Defence Roll DM	Traits
Minigun	7	0.5	3D	3	Cr200000	600	Cr1000	+0	Auto 6
Laser	10	0.5	1D	4	Cr250000	—	—	+1	Auto 3
Gauss gun	12	1	4D	3	Cr350000	1200	Cr2000	+2	Auto 6
Advanced Laser	13	1	2D	2	Cr500000	—	—	+4	Auto 4

Chemical Camouflage	TL	Minimum Range	Detection DM	Notes	Cost per Vehicle Space
Basic	5	100 metres	-1	Chemical coating	Cr500
Improved	8	20 metres	-2	+Active counter-emissions	Cr1000
Enhanced	10	10 metres	-3	+Active negation	Cr5000
Advanced	12	0 metres	-4	+Active nanotech particle capture	Cr10000

Chemical Sensor	TL	Range	Detection DM	Notes	Cost
Basic	8	1km	+1	Basic detection	Cr50000
Improved	10	5km	+2	Heightened analytics	Cr100000
Enhanced	12	10km	+3	Heightened sensitivity	Cr200000
Advanced	14	20km	+4	Single molecule detection	Cr500000

laser at TL13. All are ineffective against energy-based weapons but plasma missiles and specialised plasma ammunition are considered solid projectiles.

All systems can be used under manual control as ordinary vehicle-based weapons fired from an internal gunner's station and gain its defence roll DM on the attack roll but they still use ammunition at the same rate.

These systems require a powered vehicle. Anti-missile minigun and gauss gun turrets can install an autoloader (see page 103) consuming one Space and with normal autoloader costs and benefits. The turret can be configured as a pop-up turret by doubling the Spaces it consumes and paying pop-up Costs (see page 103). It is also capable of being a modular mount at an increase of 50% to the entire system's Cost.

CHEMICAL CAMOUFLAGE

This specialised camouflage option is designed to thwart chemical (or olfactory) sensors or Recon checks reliant on scent. At TL8 and above, chemical camouflage requires a powered vehicle.

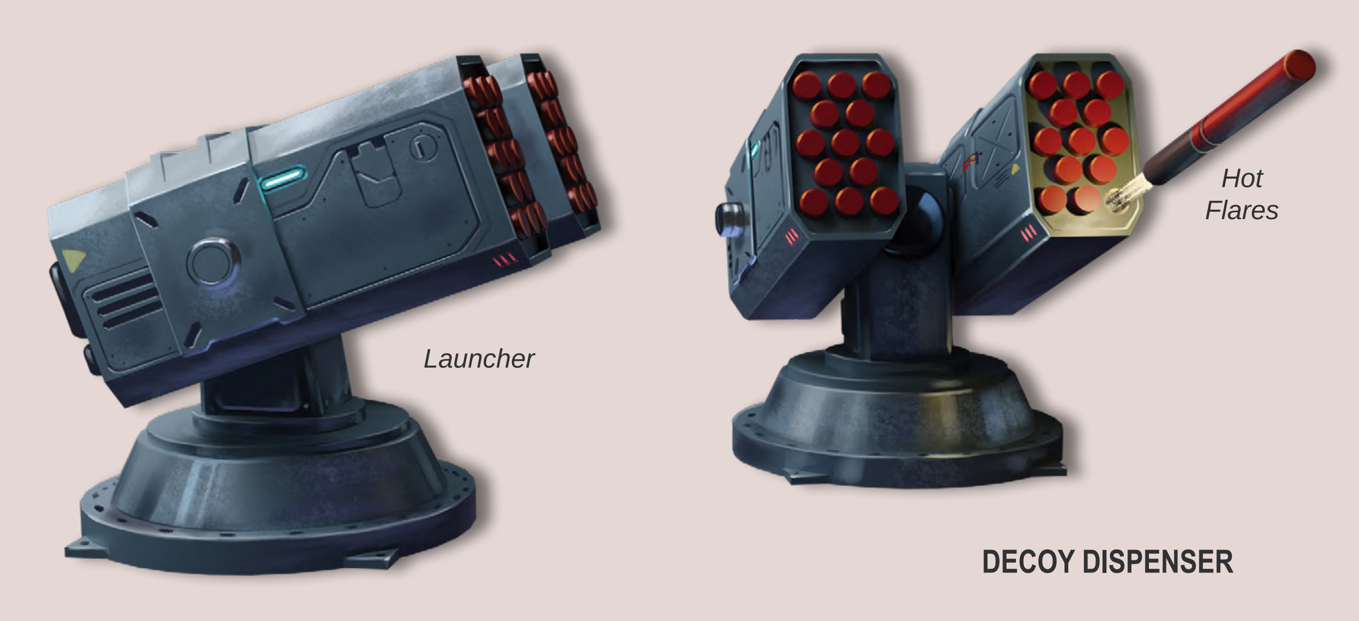
CHEMICAL SENSOR

A chemical sensor is a set of surface receptors that can capture molecules from the environment and analyse them against a known set of patterns to detect chemical or biological properties of nearby objects and determine their location. It can function even in Trace or Vacuum atmospheres if chemical emissions are present but at DM-1 and DM-2 respectively, to Electronics (sensors) checks. It performs the same tasks as external sampler (see page 69) for atmospheric gas analysis. Chemical sensors require a powered vehicle.

DECOY DISPENSER

Decoy dispensers throw out either hot flares or groups of reflective strips (chaff) to confuse and disrupt the targeting of guided weapons. Dispensers intended for use underwater typically use acoustic signatures to trick incoming attacks.

Smart weapons that target a vehicle equipped with a decoy dispenser suffer DM-2 to their attack rolls. However, decoy dispensers are completely ignored by Smart weapons that are of a higher Tech Level than the vehicle they are attacking. A vehicle must deploy



a decoy every round it is under attack for it to be effective. One dispenser can hold 60 decoys. Decoy dispensers do not provide any advantage in sensor detection, just on the final lock required for a Smart weapon attack roll.

Decoy dispensers of TL7 or less will only apply their DM if the crew of the vehicle are aware that the attack is incoming and one crew member uses a Minor Action to trigger it.

	TL	Spaces	Cost per Space
Decoy Dispenser	5	1	Cr2500

DENSITOMETER

The densitometer uses an object's natural gravity to measure its density, building a three-dimensional image of the object's surface and interior. A vehicle-scale densitometer's range depends on the size of the object being scanned. For a Basic densitometer, a detailed scan of a Small vehicle is possible at one kilometre, with each increase in size doubling the range, so a Light vehicle can be scanned at two kilometres, a Heavy at four kilometres and so on. A densitometer can penetrate the ground to its full range in soil or loose rock but solid rock or metal can reduce this by as much as half. Superdense armour reduces the densitometer's resolving power and range by 75% and molecular bonded and more advanced armour completely blocks the signal. Densitometers require a powered vehicle.

ELECTRONIC COUNTERMEASURES

A vehicle equipped with an electronic countermeasures (ECM) system is capable of disrupting both communications and attempts to use sensors to detect it. In the case of the latter, it will be obvious that the vehicle is in the vicinity since electronic countermeasures are an active broadcast but will interfere with attempts to pinpoint or analyse the vehicle. Electronic countermeasures require a powered vehicle.

Electronic countermeasures apply a negative DM to Electronics (comms or sensors) checks equal to the difference between their Tech Level and that of the device they are trying to jam or disrupt. They have no effect on devices of a higher Tech Level, nor can they be combined with stealth. They affect all devices in the area, including those of friendly forces, but ECM can be operated in a 'downgraded mode' by reducing its effective Tech Level by one to affect only devices of lower Tech Levels.

The range of ECM can be increased. Every time its range is multiplied by 10, its Cost and Spaces are doubled. This can be done twice.

Densitometer	TL	Range (Small vehicle)	Spaces	Cost
Basic	12	1km	4	Cr50000
Improved	14	2km	2	Cr50000
Advanced	15	4km	1	Cr100000

Electronic Countermeasures System

Sensor Systems	TL	Range (km)	Electronics (sensors) DM	Spaces*	Cost per Space
Basic	5	1	-0	1	Cr10000
Improved	8	5	-1	1	Cr20000
Enhanced	11	15	-2	1	Cr40000
Advanced	13	25	-3	1	Cr80000
Superior	16	50	-4	1	Cr160000

* Electronic countermeasures consume one Space by default, two Spaces at x10 range and four Spaces at x100 range.

ELECTROSTATIC ARMOUR

Electrostatic armour generates a powerful static electric field around a vehicle, vaporising objects that come close. This field extends 1–5 metres from the vehicle's exterior and is intended to vaporise shells and missiles before they strike the hull.

Electrostatic armour provides additional Protection equal to three times the Tech Level of the vehicle it is installed within.

This Protection can only be applied to projectile weapons (such as bullets, shells and missiles) and never to energy-based weapons. In addition, it can easily be overwhelmed and will only provide this Protection to one attack every round. This increases by one extra attack per round for every TL above 9.

A further drawback is that an active field is extremely harmful to Travellers and animals. Any living creature moving into the field suffers 6D damage but this is subject to the same limit of 'attacks' as from projectile weapons. Activating electrostatic armour on a vehicle travelling on the ground through dense brush or forest regions can damage flora and start fires. This quickly reaches the per round limit of the armour's 'attacks', rendering it ineffective, although it might inadvertently create a smoke screen. Electrostatic armour can only be activated within a liquid if the vehicle is using a supercavitating drive.

Electrostatic armour does not affect people within the vehicle but it is dangerous to leave when the armour is engaged. Projectile weapons fired from the vehicle suffer the same effects as an attack on the vehicle but energy weapons are unaffected. Electrostatic armour is not compatible with reactive armour (see page 77) as it can cause premature detonations. When active, Electrostatic armour invalidates any of the vehicle's stealth or electronic countermeasure DMs.

Electrostatic armour consumes 10% of a vehicle's total number of Spaces and requires a powered vehicle.

	TL	Spaces*	Cost per Space consumed
Electrostatic Armour	9	10%	Cr10000

* Electrostatic armour consumes a minimum of five Spaces.

MESON SCREEN

A meson screen blocks attacks from meson weapons by preventing meson decay. An Average (8+) Gunner (screens) check reduces damage from a meson weapon by (2D+Effect) × 50 points and removes its Radiation trait. Multiple meson screens can be used by a single operator against a single attack but each attempt requires a separate check; if there is only one operator, they receive a penalty for attempting multiple tasks in a round. Even unsuccessful checks can reduce some damage, unless the negative Effect is greater than the 2D roll. Any check that reduces at least some damage also removes the Radiation trait of the attack.

An operational meson screen disrupts meson attacks within a sphere of up to 100 metres from the vehicle but cannot extend to protect other vehicles, people or ground installations further away. A powered meson screen also prevents any meson communicators from functioning within the sphere.

A meson screen consumes 12 Spaces and requires 9 Power from a nuclear power plant to function.

	TL	Spaces	Cost
Meson Screen	13	12	MCr1

NAS

The Neural Activity Scanner (NAS) consists of sensors and a control and display console and can detect neural activity up to five kilometres away. The device can also give a rough estimation of the intelligence level of organisms based on brainwave patterns. A NAS requires a powered vehicle.

Item	TL	Effect	Spaces	Cost
NAS	15	Neural activity detection and analysis	1	Cr200000

NUCLEAR DAMPER

The nuclear damper projects a wave that modifies the strong nuclear force. This can prevent the detonation of nuclear weapons or at least remove a lot of their secondary effects.

A vehicle equipped with a nuclear damper ignores the Radiation trait of any weapon that damages it. Furthermore, it prevents the detonation of nuclear weapon within one kilometre with a successful Difficult (10+) Electronics (sensors) check (INT or EDU). This check can be performed as a reaction.

A nuclear damper consumes 12 Spaces and requires 6 Power from a nuclear power plant to function. It needs a dedicated crewmember to operate it.

	TL	Spaces	Cost
Nuclear Damper	12	12	Cr500000

PRISMATIC AEROSOL DISCHARGER

Similar to a smoke discharger, a prismatic aerosol deploys a cloud of very fine crystal shards that refract and deflect laser light.

Attacks with laser-based weapons made against a vehicle using a prismatic aerosol discharger have their damage reduced by 2D. It has no effect on non-laser or Destructive laser weapons. A prismatic aerosol discharger has no effect defending a moving vehicle or when in anything stronger than a moderate breeze. One discharger holds 30 charges.

	TL	Spaces	Cost
Prismatic Aerosol Discharger	9	1	Cr4000

REACTIVE ARMOUR

This is a set of small explosive charges positioned on critical areas of a vehicle's exterior that automatically detonate when struck by a weapon.

This provides a bonus to the Protection of a vehicle's armour but degrades over successive hits as the explosives are expended. The bonus is reduced by -1 by each successful hit or by -5 for any hits from Destructive or spacecraft-scale weapons.

Reactive armour is incompatible with electrostatic armour (see page 76) and will detonate when in an electrostatic armour field on a 1D roll of 6, checked every combat round.

The cost of reactive armour is based upon the total number of Spaces of the vehicle, although it consumes no Spaces itself. It costs Cr2000 to replace each lost point of Protection gained from reactive armour.

Reactive Armour	TL	Protection	Cost per Vehicle Space
Basic	7	+15	Cr1000
Improved	9	+25	Cr2500
Advanced	11	+30	Cr5000

RECON SENSOR

A recon sensor uses an aggregate of existing sensors and its own collectors to actively map the environment while looking for movement or anomalies. It brings a detection to the attention of the crew for them to take appropriate action. The package emulates the Recon skill and can only be installed once. It is usable against camouflage, stealth and electronic defences, includes visual, auditory, chemical and electronic detection components, and can be used in lieu of Electronics (sensors) to detect targets of reduced electronic signature. The effective skill of the sensor replaces an operator's Recon or Electronics (sensors) skill and does not stack with them or allow use in a task chain. A recon sensor requires a powered vehicle.

Recon Sensor	TL	Recon Skill	Cost
Basic	8	1	Cr10000
Improved	10	2	Cr20000
Enhanced	12	3	Cr50000
Advanced	14	4	Cr100000

SMOKE DISCHARGER

A smoke discharger wreathes a stationary vehicle in smoke, making visual targeting difficult.

Attacks made against a vehicle using a smoke discharger suffer DM-2. Attacks made with any fire control system of TL9+ are unaffected by smoke. A smoke discharger has no effect defending a moving vehicle or when in anything stronger than a moderate breeze. One discharger can hold 30 charges.

	TL	Spaces	Cost
Smoke Discharger	3	1	Cr1000

INTERNAL OPTIONS

Certain options are primarily internal to the vehicle. They may extend to the vehicle's surface but are mostly placed inside it and range from protective measures to options enhancing an occupant's experience to a variety of facilities typically found in larger vehicles, structures and even spacecraft.

ENVIRONMENTAL INTERIOR PROTECTION

Even if the hull of a vehicle is protected from hostile conditions, those inside must also have protection or they will slowly suffocate inside a sealed container. In some instances, the occupants themselves may wear protective equipment and the vehicle might offer some or no protection from the elements. This might work for a short period of time but for any excursion of more than a few hours, the vehicle must be equipped with life support and other equipment to enable the crew to survive.

AIRLOCK

A vital complement to most environmental protection options, an airlock allows occupants to enter and exit the vehicle without compromising its internal environment. An airlock is not strictly necessary but a vehicle without one must expose the interior to exterior conditions every time someone enters or exits. An airlock includes a docking hatch (see page 65).

An airlock can hold two people or a total of 250 kilograms of people and equipment (including vacc suits and armour). Additional airlocks can be combined to handle an additional pair of people or 250 kilograms per two Space airlock. Some species require larger airlocks; eight Spaces for a pair of Virushi, or six Spaces per pair of K'kree, although K'kree airlocks are usually sized to accommodate more than two at a time. Airlocks require two combat rounds to fully cycle.

	TL	Spaces	Cost per Item
Airlock	6	2	Cr2000

BIOSPHERE

A biosphere is an area dedicated to flora and fauna, either to produce food or for leisure. Connected to recycling and atmosphere-maintenance equipment, it also supplements long-term and closed cycle life support systems (see page 80). For every 2 Spaces of biosphere, the life support requirements of one crew member are met. A vehicle must also allocate 1 Space of closed-cycle life support (see page 80) to provide proper recycling to support the entire biosphere, regardless of the number of people the biosphere supports.

In addition, a biosphere space adds to the overall comfort of occupants. If the atmosphere of a biosphere is disrupted, such as from sudden depressurisation, infiltration of toxic atmospheres, or long-term power outages, the living components of the biosphere must be replaced at 10% the Cost of each biosphere Space. A biosphere does not require power to function but in its absence, it requires the labour of one person per 20 persons supported to function. This labour can substitute for power to the required life support equipment.

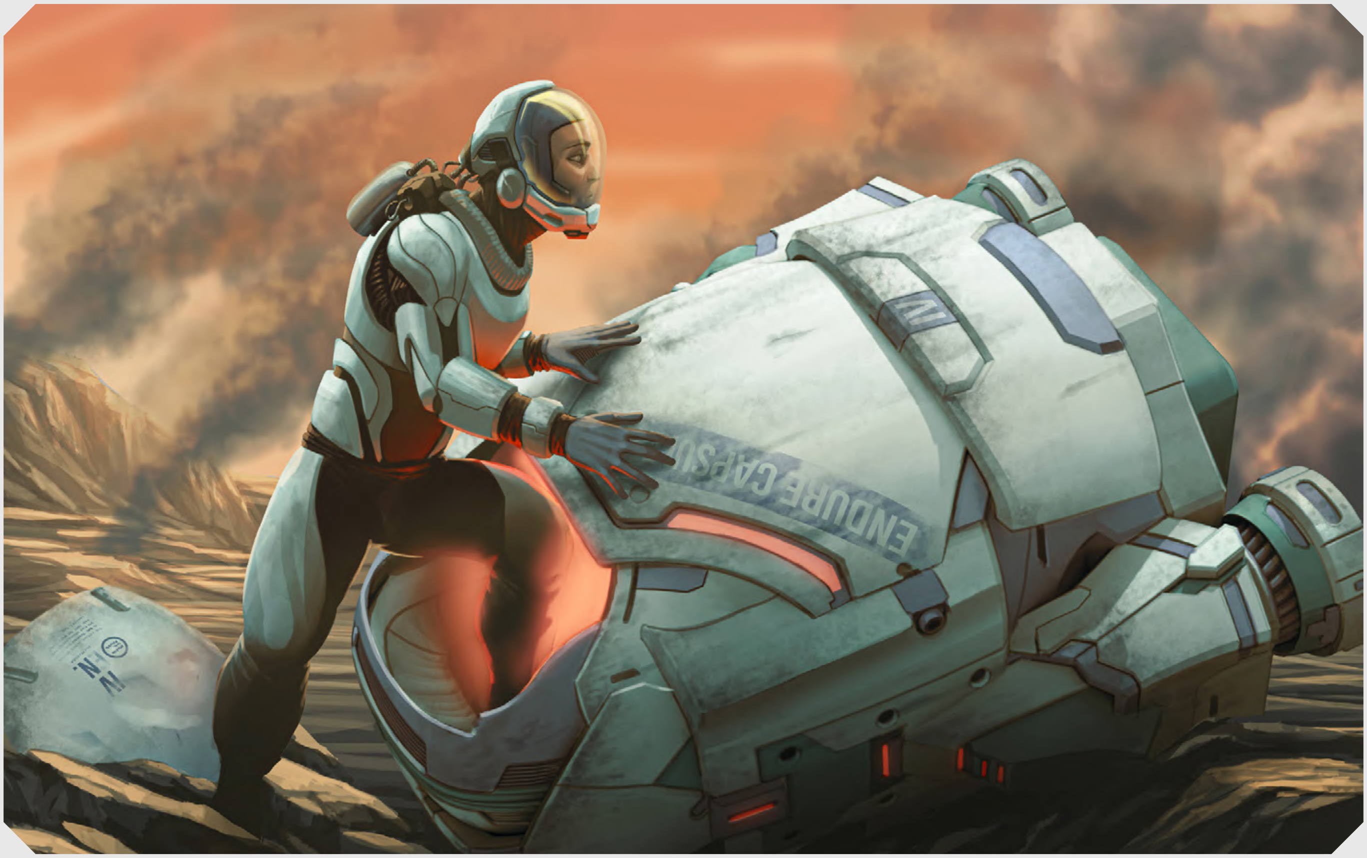
	TL	Effect	Spaces*	CP	Cost per Space
Biosphere	8	Life Support for one person	2	2 per Space	Cr50000

* Biosphere Space consumption varies by the size of the sophont.

CLEAN ROOM

This option adds filters, dust-resistant surfaces and ventilation to a Space within a vehicle or structure to prevent contamination from interfering with delicate operations. A clean room environment is automatically included in laboratories and medical bays. Clean rooms are required for external fabrication requiring advanced features such as electronics or precision equipment. It is often added to factories manufacturing specialised products.

	TL	Effect	Cost per Space
Clean Room	5	Low particulate environment	Cr500



COLLISION PROTECTION

Occupants of a vehicle can suffer serious injury in a collision. A collision protection system protects the Spaces used by a vehicle's occupants, provided it covers at least all of the Spaces dedicated to their seating. If a vehicle contains additional accommodations, those Spaces can be protected from collisions as well and sometimes the entire interior is protected out of expedience. It does not protect against direct weapon damage but may offer a defence against concussive blasts at the Referee's discretion.

At lower Tech Levels, collision protection is in the form of airbags. At TL9 the protection comes from oxygenated gel dispensers and at TL12 it includes short-acting grav plates. Once a collision protection system is activated, it must be replaced in its entirety at 110% of the initial Cost to restore functionality.

All collision protection systems operate on internal battery power and do not require vehicle power to operate. They also include vehicle-wide fire suppression equipment and do not need additional fire extinguishers (see page 80). When activated, they power off the vehicle, requiring 1D rounds to restart the system (if it is still functional) and clear away any bags, gel or residual gravitic effects to allow access to control interfaces and systems or for beginning repairs.

Collision Protection	TL	Protection	Cost per Space Protected
Basic	7	+8	Cr500
Improved	9	+12	Cr1000
Advanced	12	+20	Cr2000

EJECTION COCOON

Similar to an ejection seat, the cocoon is a lightly armoured shell that provides a limited, pressurised environment. It is normally used in supersonic or faster aeroplanes and grav vehicles, where ejection could be dangerous, or on any vehicle when ejection is expected within hostile environments. If used in a submarine, it allows the occupant to surface from any depth at or above the vehicle's Crush Depth.

An ejection cocoon consumes 3 Spaces for each crew member and costs Cr10000 per Space. These Spaces are considered equipment and protective structures, and separate from the Space required for the crewmember. The cocoon is not required to scale with the Space requirements of the occupant. An ejection Cocoon provides Protection +10 to the occupant and crash-cushioning features allow this Protection to apply to any collision damage but this is separate from and does not stack with any collision protection. It does not require a powered vehicle.

An ejection cocoon is compatible with life support seats (see page 81). Without life support, it will sustain its occupant for a number of hours equal to half its Tech Level, rounded down.

	TL	Spaces per crew	Cost per Space
Ejection Cocoon	8	3	Cr10000

EJECTION SEAT

Ejection seats are designed to blast a person clear of a disabled vehicle, then deploy a parachute to bring them safely to the ground. An ejection seat can be triggered as a reaction but those of TL6 or below require the vehicle (usually an aircraft) to be at an altitude of at least 500 metres. Ejection seats at TL10 or above use grav chutes to bring the occupant to rest.

An ejection seat consumes no Spaces and costs Cr5000 but the occupant it protects requires a minimum volume, limiting the total number of ejection seats available in a vehicle to no more than one per vehicle Space. It does not require a powered vehicle. An ejection seat may have the life support seat (see page 81) added.

	TL	Cost
Ejection Seat	5	Cr5000

FIRE EXTINGUISHERS

Fire extinguishers are designed to put out fires internal to the vehicle. If a vehicle catches fire, the extinguisher can be activated as a reaction. For the next 1D rounds, roll 2D. On an 8+, the fire is put out.

	TL	Cost per Vehicle Space
Fire Extinguishers	5	Cr20

GRAV PLATING

A vehicle can install grav plating to provide comfort for occupants in low or high gravity environments. Grav plating only functions on a vehicle that has grav drives or lifters installed, although those systems need not be in use to activate it. Grav plating does not provide acceleration compensation, unless that acceleration occurs perpendicular to the placement of the grav plates. A grav plate can alter interior vehicle gravity by ±2gs, either providing gravity in zero, or low-gravity environments, or countering up to 2Gs in a high-gravity environment. They can provide zero gravity in a structure on the surface of a world for training and experiments.

As with lifters, grav plating requires a powered vehicle, whose power is depleted at a similar rate (see page 80).

	TL	Spaces*	CP per Space	Cost per Vehicle Space
Grav Plating	10	1%	1	Cr2000

* Grav Plating consumes a minimum of one Space.

INERTIAL COMPENSATOR

An inertial compensator works with grav drives to counter acceleration experienced by those within the vehicle. While standard as part of manoeuvre drives, they are an additional component on vehicles with grav drives or lifters. A single application of vehicle-class inertial compensators only compensates for 1G acceleration but can be used in conjunction with grav plates to provide higher effective compensation against constant thrust in the direction perpendicular to the grav plates.

Multiple applications of inertial compensators can increase the compensation at 1G per application, to a maximum of the vehicle's TL-7. Inertial compensators provide some buffering during collisions, reducing the force of impact by one point per damage dice inflicted – multiple applications will not further reduce damage.

As with lifters and grav plating, inertial compensators require a powered vehicle, whose power is depleted at a similar rate (see page 80).

	TL	Spaces*	Cost per Vehicle Space
Inertial Compensator	10	0.5%	Cr2000

* Inertial compensators consume a minimum of one Space.

LIFE SUPPORT

Life-support systems provide a sealed vehicle with a breathable atmosphere independent to that outside and requires at least hostile environment protection to be effective. Life-support systems are rated by the number of people and the duration they support. Cost of life support is based on the Spaces consumed by the equipment.

Short term life support systems operate for up to four days before air and filters need to be replaced (included as part of the vehicle's regular maintenance costs). It consumes one Space for every 20 people (or

Life Support	TL	Duration	Spaces consumed*	Cost per Space consumed
Short Term	4	4 days	1 per 20 people	Cr10000
Long Term	6	90 days	1 per 5 people	Cr50000
Closed Cycle	8	Indefinite	1 per 5 people	Cr100000

* Life Support consumes a minimum of one Space.

part of) on board the vehicle. Short-term systems are not designed to last more than four days, regardless of how few occupants are present.

Long-term life support operates for up to 90 days and consumes one Space for every five occupants. At higher TL8+ and for higher cost, a closed-cycle system is available, capable of supporting five occupants indefinitely per Space consumed, assuming routine maintenance is conducted.

Both long-term and closed-cycle systems recycle waste products. Neither includes a fresher, nor do they necessarily require a fresher to 'feed' the system, but most inhabitants find the interior space more palatable if at least one fresher is installed. If used in conjunction with a biosphere (see page 78), only one Space of closed-cycle life support must be installed; the biosphere will handle the rest but a full system is often included for redundancy.

All life-support systems require a powered vehicle. In an unpowered state, the duration of life support falls dramatically, with the remaining duration dropping from days to hours and even closed-cycle life support failing entirely within a week, although a functioning biosphere will delay failure if manually maintained (see page 78). If the life support system is exceeded, each additional person per Space consumed of the system reduces the duration by two hours for short term life support or by half its duration for long-term life support.

Closed cycle life support systems become stressed by additional people, suffering a mechanical failure on a roll of 12+ per day, with DM+1 for every five additional people or fraction thereof. Mechanical failures require an Average (8+) Mechanic check (1D hours, INT or EDU), with the life-support system failing entirely on a failed check, at least until a successful check occurs. Failure causes suffocation if it is offline for more hours than half its Tech Level, rounded down. Each failure inflict DM-1 to the next failure roll until life support is restored.

LIFE SUPPORT SEAT

Extremely space-conscious designs for hostile environments can have a short term life support system built into an occupant's seat. This system requires the occupant to remain in or adjacent to the seat for it to function, although it will allow for short forays to other areas inside a Small or Light vehicle if the vehicle itself is pressurised or protected from vacuum.

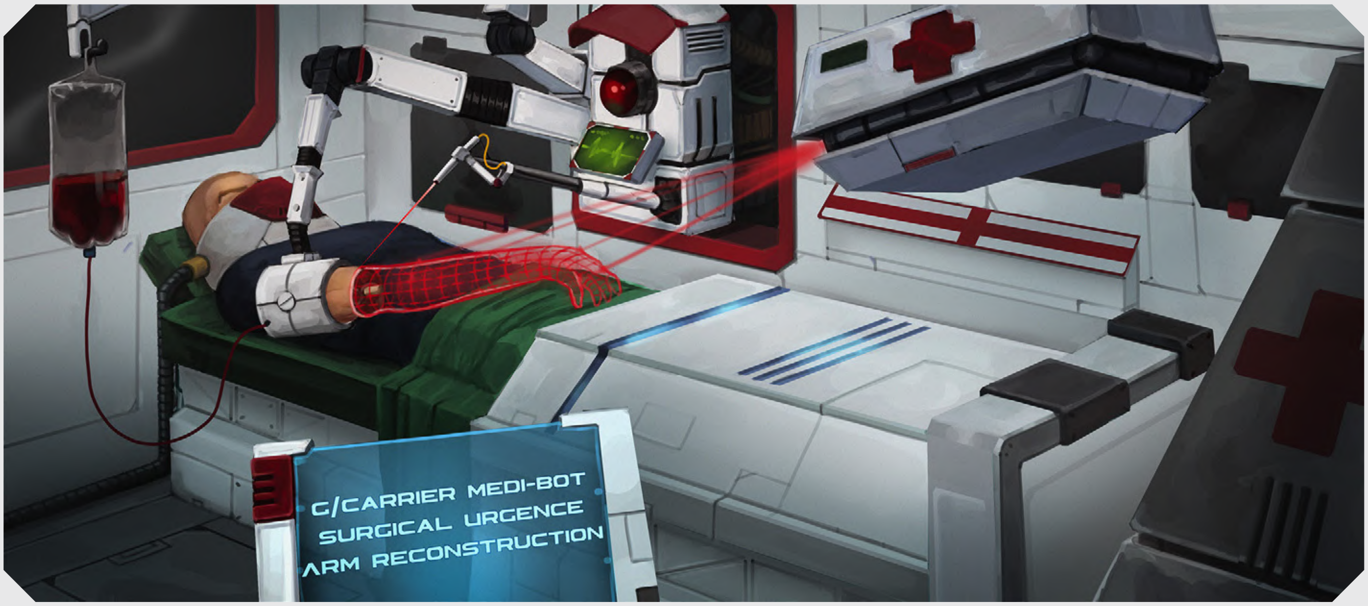
The seat is not useful for an unprotected occupant unless the vehicle itself is pressurised or protected from vacuum but it can work to extend a vacc suit's life support in an unpressurised vehicle for up to four days if the suit remains attached to a set of standard umbilicals included with the seat. The life support seat requires a powered vehicle. It can be installed on an ejection seat (see page 80) or associated with an ejection cocoon (see page 79) but as with an ejection seat, it supports a certain volume of Spaces, limiting the total number of life-support seats in a vehicle to no more than one per vehicle Space.

	TL	Effect	Cost
Life Support Seat	6	Short Term life support for one person	Cr5000

CREATURE COMFORTS

Some of these items are also listed in the *Traveller Core Rulebook* and *Central Supply Catalogue*. Other items from these books can be included in a vehicle using an assumption that most will occupy one Space per 250 kilograms and, within reason, individual items of less than 50 kilograms need not be tracked for Space allocation.

Some items consume Spaces in direct proportion to the size of the sophont for which the vehicle is designed and this is indicated in their description. Speciality items such as autodocs, cryoberths and low berths are more complicated and only listed for human-sized sophonts. For those willing to change this, a good starting assumption is to add one Space to an item for each Space more than one that the sophont requires and add at least 10% to the Cost of the item for each additional Space consumed.



AUTODOC

An autodoc is a small self-contained diagnostic, pharmaceutical and surgical system about the size of a low berth chamber. The autodoc is essentially a stationary robot capable of diagnosing and treating disease, infection, injuries and other medical conditions as efficiently as a qualified doctor. The Basic autodoc has the equivalent of Medic 3 and Science (biology) 2.

A TL14 Improved autodoc is capable of reanimation, provided no more than 2D minutes have passed since the patient's death. This period can be doubled by extremely cold conditions or extended up to 1D days if the patient's corpse has been placed in a low berth or cryoberth, although revival checks for those devices still apply. The Improved autodoc includes an integral low berth and bioreactor capable of regrowing limbs or organs. It has the equivalent of Medic 3 and Science (biology) 3.

The Advanced TL15 autodoc is a smarter machine and includes a fabrication chamber capable of both regenerating tissue and crafting simple augments. Its sophisticated sensors (bioscanner and NAS) and science toolkit allow it to perform investigative work to analyse unknown illnesses or other medical conditions. Its skills include Investigate 4, Medic 4, Science (biology) 4 and (chemistry) 4.

Most autodocs match the form-factor of standard low berths, allowing a replacement or 'upgrade' of a low berth or cryoberth to an autodoc in the same fitting.

All autodocs require a powered vehicle but can preserve a cryogenically frozen person for up to one week on internal battery power.

BUNK

A bunk provides cramped sleeping space and a small amount (10 kilograms or so) of storage for up to two persons. They are often crammed into narrow spaces in nooks and crannies and offer only limited rest.

Some vehicles may use 'hot bunking' where multiple shifts share one bunk. If a vehicle has crew to cover three shifts, up to three people may use the same bunk and so up to six people can be accommodated by a single bunk Space.

Autodoc	TL	Features	Spaces	Cost
Basic	13	Diagnosis, drug delivery, surgery, Medic 3	2	Cr100000
Improved	14	Reanimation, low berth, bioreactor, Medic 3	2	MCr1
Advanced	15	Advanced sensors, science toolkit, Medic 4	2	MCr3

	TL	Effect	Spaces*	CP	Cost per Space
Bunk	0	Sleeping berth for 2 persons and storage	1	1	Cr200

* Bunk Space consumption varies by the size of the sophont.

COMMON AREA

A common area is set aside to allow greater comfort during long voyages. A standard common area includes seating, tables and room to move around to alleviate the stress of being confined. Entertainment equipment, freshers, sleeping berths, galleys and other comfort areas are treated separately but can be retrofitted into a common area with little difficulty.

	TL	Space	CP	Cost per Space
Common Area	0	1	1	Cr100

CRYOBERTH

A cryoberth, or 'icebox', is a coffin-like machine similar to low berths. Unlike a low berth, a cryoberth is designed to quickly (within one combat round) freeze an individual, usually in response to severe medical trauma. This process carries inherent risk, and the individual must perform a low berth survival check on both entry and exit from cryoberth-induced hibernation (see *Traveller Core Rulebook*, page 158). Checks applied to aid the entry cryoberth survival check are considered rushed, inflicting DM-2 and often forgone if no qualified individual is available. As with a low berth, at TL12+ survival checks receive DM+1. Low berths are specific to a particular sophont species. Those designed for humans inflict DM-2 to non-humans and vice versa.

Revival is slower than freezing. The procedure for revival is a Routine (6+) Medic check (1D x 10 minutes, INT).

The cryoberth's internal power system can function for up to one week on its own batteries but a berth is usually connected to a vehicle power supply.

Cryoberth	TL	Effect	Spaces	Cost
Basic	10	Freeze injured patient within seconds	1	Cr50000
Improved	12	DM+1 to survival checks	1	Cr50000

ENTERTAINMENT SYSTEM

Entertainment in low Tech Level vehicles tends to concentrate on audio capabilities but rapidly advance to include visual media. Entertainment systems consume no Spaces and cost Cr200. However, Travellers looking to impress other passengers are free to spend more. A lot more. Each increase in the system's value is equal to 0.1 Comfort Points and will also improve the Comfort Points of luxury interior spaces. Entertainment systems require a powered vehicle.

	TL	CP	Cost
Entertainment System	5	0.1	Cr200

FRESHER

A half fresher is a toilet and sink in a cramped compartment. A standard fresher provides hygienic services and comes complete with toilet, sink and shower in a compact form factor. A full fresher can be installed instead and is a full-sized washroom, complete with tub, shower, vanity with sink, toilet and bidet, or equivalent fixtures suitable to the occupant's physiology.

GALLEY

A galley provides food preparation and serving facilities, although common areas must be provided if a separate eating area is desired; a table and chair occupying one common area Space per person.

Fresher	TL	Effect	Spaces*	CP	Cost per Space
Half	4	Toilet and sink	1	1	Cr500
Standard	5	Toilet, sink and shower	2	2	Cr750
Full	5	Tub, shower, vanity with sink, toilet and bidet	4	8	Cr1500

* Freshers increase in Space and Cost requirements in proportion to the size of their users; for instance, a single Virushi would require the equivalent of four freshers.

Galley	TL	Effect	Spaces*	CP	Cost per Space
Mini	2	Basic fare for up to 4 at a time	1	1	Cr250
Full	2	Full meals for up to 10 at a time	5	5	Cr500
Gourmet	3	Gourmet meals for up to 4 at a time	5	10	Cr2000

* Space consumption varies by the size of the sophont.

Holographic Projector	TL	Effect	DM	Spaces Displayed per Space Installed*	Cost per Space
Basic	9	Translucent moving holograph	-1	×10	Cr100000
Improved	11	Realistic moving holograph	-2	×20	Cr200000
Enhanced	12	True-to-life moving hologram	-3	×50	MCr1
Advanced	14	Larger display volume	-4	×100	MCr2.5

* A holographic projector consumes at least one Space.

Low Berth	TL	Effect	Spaces	Cost
Basic	10	Freeze injured patient within 1D minutes	2	Cr50000
Improved	12	DM+1 to survival checks	2	Cr50000

A mini-galley contains simple food storage and preparation equipment to serve up to four people at a time. A full galley provides full kitchen facilities to prepare a meal for up to 10 people, while a gourmet galley can prepare and serve high-quality fare for four diners.

HOLOGRAPHIC PROJECTOR

Many items have holographic displays or projectors as part of their control or entertainment system. A stand-alone vehicle-installed holographic projector can produce a much larger image, displaying it either within a vehicle or outside it, within a few dozen metres. When installed, the holographic projector's location (interior or exterior) should be specified. A projector is rated by its sophistication and the volume in Spaces in which it can display, equal to 10–100 times the Spaces it consumes, depending on its version, and requires a powered vehicle.

An external holographic projector can be used as an improvised form of camouflage that affects the indicated DM to observers attempting a Recon check from one 90° arc opposed to the vehicle. If the Recon check is aided by sensors, such as PRIS binoculars, the difference in Tech Level between the visual sensor and the holographic projector provides a DM to the observer – a more advanced viewer is more likely to detect a lower tech projector attempting camouflage than a vehicle that forgoes the attempt.

LOW BERTH

The low berth is a hibernation unit, usually found on spacecraft. In vehicles, they are often part of an emergency response system, where accident victims can be placed into hibernation to prevent their condition from getting worse. Each low berth holds one occupant. It is safer than a cryoberth, only requiring a survival check upon revival, but the hibernation process takes 1D minutes, time a mortally wounded occupant might not have. Revival requires a Routine (6+) Medic check (1D x 10 minutes, INT).

At TL12+, a more advanced version provides DM+1 to survival. Low berths are specific to a particular sophont species. Those designed for humans inflict DM-2 to non-humans and vice versa.

The low berth's internal power system can function for up to one week on its own batteries but usually connects to a vehicle power supply.

LUXURY INTERIOR SPACE

Luxury interior space is anything but common areas. Any number of Spaces can become luxury space with increasing levels of high-end amenities, the variety of which are too vast to specify in all but general terms. At higher Tech Levels, more advanced systems, including holographic entertainment become available. Each level of luxury space provides an increasing multiplier to Comfort Points of the Space it occupies. A vehicle with a luxury exterior often has an interior with the best luxury available at its Tech Level, although perhaps only for the passenger compartment. If the entire interior space accessible by occupants (or at least passengers or residents, the crew might have common areas) then the vehicle's rating for SOC increases by +1.

Luxury interior space does not consume extra Spaces but increases the luxury of common areas. An entertainment system of appropriate quality is included but an additional system would add more features and still add Comfort Points. Improved, Enhanced and Advanced luxury space requires a powered vehicle.

Luxury Interior Space	TL	Effect	CP	Cost per Space
Basic	2	Expensive furnishings, stocked with food and drink	2	Cr1000
Improved	6	Entertainment systems, plumbing for hot tub or wet bar	3	Cr3000
Enhanced	9	Full configurable surfaces	4	Cr5000
Advanced	11	Holographic entertainment features	5	Cr10000

Recreational Space	TL	Description	Minimum Spaces*	CP per Space	Cost per Space
Common Area	0	Common or open space suitable for recreation	1	1	Cr100
Garden	0	Space with edible or comforting flora	5	2	Cr500
Park	0	Varied and maintained parkland	50	3	Cr1000
Venue (basic)	1	Art or sports area, stadium or hall	100	4	Cr5000
Venue (improved)	9	Improved recreational infrastructure	100	5	Cr10000
Venue (advanced)	11	Advanced holographic infrastructure	50	6	Cr20000

*Each Recreational Space is allocated in units of minimum Spaces and is scaled by sophont size requirements.

	TL	Effect	Spaces*	CP	Cost per Space
Sleeping Berth	1	Sleeping berth and storage for one person	1	1	Cr500

* Sleeping berth Space consumption varies by the size of the sophont.

RECREATIONAL SPACES

A large vehicle or structure intended for prolonged or permanent occupation can include common areas for recreation and relaxation. These Spaces might vary in quality but all contribute to the overall wellbeing of the inhabitants. The lowest quality recreational space is equivalent to the common space option, and specific facilities can be detailed if desired, but the following table generalises the quality of recreational spaces based on the Comfort Points they provide. Improved and advanced venues require power. Other forms of reactional spaces require only a habitable environment.

SLEEPING BERTH

A sleeping berth is a privacy-curtained bunk, usually equipped with at least a basic entertainment system and storage for up to 50 kilograms of luggage or other items. It is considered a step up from a reclining seat or bunk or voyages lasting more than a day. Some sleeping berths are stacked two-high within a living space, others are seating pods that can stretch to allow the occupant to lie flat.

STATEROOM

Stateroom quality can vary greatly. A private accommodation with a place to sleep and a place to sit is a bare minimum but some staterooms accomplish this by folding beds and chairs or tables into the wall, allowing barely enough room to move. Others provide standard accommodation for one or two individuals and with increasing cost and dimensions, include fixtures such as freshers, galleys and luxury space. Staterooms are sufficient accommodations for short-term occupancy in a travelling vehicle or a hotel. Permanent accommodations are often cheaper per Space but require more Space per individual; these are detailed in the Residential Accommodations section on page 85. Advanced and Superior staterooms require a powered vehicle.

Stateroom	TL	Effect	Spaces*	CP per Space	Cost per Space
Basic	1	Minimal private accommodations for one person	4	1	Cr2000
Improved	1	Cramped accommodations for one or two people	8	1	Cr4000
Enhanced	2	Standard accommodations + Standard fresher	12	1	Cr5000
Advanced	5	Good accommodations, full fresher, mini galley	16	1	Cr8000
Superior	11	Luxury accommodations, full fresher, mini galley	20	2	Cr20000

* Stateroom Space consumption varies by the size of the sophont.

INTERNAL UTILITY

Some internal options have mundane but important uses. These include military, medical and scientific spaces.

ARMOURY

An armoury is a sealed cabinet or small room designed to safely secure weapons, ammunition and related equipment. An armoury is secured by a Formidable (14+) lock and access is usually limited to the vehicle's commander and any personnel with supervisory or military roles. One Space can support the weaponry needs of one soldier's combat armour, battle dress and weapon, or up to five lightly equipped personnel with soft body armour, military weapons and support materials. Up to 10 weapons and ammunition for civilian arms such as rifles and shotguns or twice as many handguns and ammunition can be stored per Space of armoury. An armoury has Protection equal to three times the base armour level for the vehicle's Tech Level and is treated as a vehicle for the purpose of absorbing small arms damage. It can absorb two hits per Space before being breached.

	TL	Cost per Space
Armoury	1	Cr10000

BRIG

A chamber with reinforced walls and an exterior Formidable (14+) lock, a brig is designed to securely hold prisoners. Its walls are protected by three times the base armour level for the Tech Level or at least Protection +6, along with at least two surveillance cameras, if available at the vehicle's Tech Level.

A small brig contains a half fresher and two fold-down bunks and can house up to four prisoners in crowded conditions. A standard brig contains a half fresher and six fold-down bunks and can house up to 12 prisoners in crowded conditions.

Brig	TL	Effect	Spaces	Cost
Small	1	Up to 4 prisoners	6	Cr50000
Standard	1	Up to 12 prisoners	16	Cr100000

COMMAND CENTRE

Used in military, law enforcement and rescue vehicles, a command centre allows the effective monitoring and co-ordination of units in high-stress operations. The command centre includes workstations and a large screen or holographic table for reports and displays. Up to two people can use a command centre at any one time, and it can be increased in size, increasing by one Space and Cr5000 for each extra person. A command centre requires a vehicle to have at least TL7 communications systems, sensors and power. A command centre enables a commander or supervisor to remotely apply Leadership and Tactics skills to action teams.

	TL	Spaces	Cost
Command Centre	7	4	Cr75000
Command Centre Extra Seat	7	1	+Cr5000

DOCKING BAY

A docking bay is a sealed compartment tightly enclosing a vehicle dock. It includes one or more hatches to allow access to the internal bay but the volume within is not large enough to do anything but load people and cargo into and out of the attached vehicle.

A docking bay consumes a number of Spaces equal to 4.4 times the Shipping tons of the vehicle to be carried, rounding up. It is configured to support a specific vehicle's shape and will not necessarily be usable for docking a very differently shaped vehicle or closing the docking bay doors.

	TL	Cost per Space
Docking Bay	3	Cr12500

HANGAR BAY

Large vehicles are fully capable of carrying smaller vehicles inside. An internal hangar bay does not simply provide the ability to carry another vehicle (which can be achieved simply by dedicating cargo space to the task) but enough space to conduct basic maintenance and facilities to deploy the vehicle inside.

A hangar bay consumes a number of Spaces equal to eight times the Shipping tons of the vehicle(s) to be carried. It includes hatches and a flexible docking hatch/vestibule.

	TL	Cost per Space
Hangar Bay	1	Cr10000

LABORATORY

A work area for scientific analysis can be either a general workspace to allow a scientist to use laboratory equipment without penalty or a tailored laboratory for specific investigation. Tailored laboratories come equipped with their own specialised equipment and are of little or no use for other specialities or analysis.

Each laboratory is sufficient for one scientist and their equipment. A primitive laboratory provides space for a scientist to work and basic tools such as beakers and a microscope; it is enough to avoid a penalty in performing tasks but has no access to the vehicle's equipment. General laboratory space assumes the scientist brings their own equipment but has access to the vehicle's sensors, communications and computer resources. Specialised laboratory spaces grant DM+3 to related Science checks or DM+1 if the scientist is using their own scientific toolkits (see *Traveller Core Rulebook* pages 121–123) in conjunction with the laboratory's equipment. A scientific toolkit adds its normal bonus in a primitive or general laboratory.

Specialised laboratories include atmospheric analysis, biological, chemistry, hydrographic analysis, planetology and xenology. With the exception of the primitive laboratory, a laboratory is equipped with toolkits of the same Tech Level as the vehicle. At TL5 and above, the Spaces occupied by the laboratory include the features of a clean room (see page 78) and require power.

LIBRARY

A library contains computer files and lecterns, display screens, holotanks and perhaps even hard copies of books. A good library is useful for both research and passing time on long journeys.

Having a library grants DM+1 on any EDU check made when training for new skills in periods of extended inactivity or dedicated education and training.

Laboratory	TL	Effect	Spaces	Cost
Laboratory: Primitive	3	No penalty for science tasks	3	Cr3000
Laboratory: General	7	No penalty, access to vehicle's equipment	2	Cr10000
Laboratory: Specialised	7	Up to DM +3, access to vehicle's equipment	3	Cr30000

Library	TL	Spaces	Cost
Library (primitive)	1	200	Cr500000
Library (basic)	2	160	Cr500000
Library (improved)	4	80	MCr1
Library (advanced)	8	16	MCr4

MEDICAL BAY

A medical bay is equipped for a skilled medic to perform surgery and heal and monitor patients. It grants DM+1 to all Medic checks made within it. A medical bay may also include items such as an autodoc, cryoberth and low berths, purchased separately.

A medical cabinet is equipped with a medikit of the vehicle's Tech level, basic drugs and supplies required for surgery.

A medical bed allows for rest, recuperation, administration of medication and monitoring of a patient. Slow drug can safely be administered to a patient in a medical bed of TL8 or above, otherwise the patient must be treated on an operating table. One medical bed provides one Comfort Point.

Surgery requires the presence of an operating table and prior to TL7 can only be performed if a vehicle is stationary or if it is a Huge or larger watercraft or submersible in relatively calm sea conditions.

The medical bay sterile option allows a sterile environment for an operating suite or intensive care unit. It is applied per Space in the medical bay and includes the benefits of a clean room (see page 78).

Operating tables require one medic per table when in use. A single medical cabinet can support storage needs for up to one medic and six patients, and a single medic can supervise up to six patients.

MULTI-ENVIRONMENT ENCLOSURE

Keeping part of a vehicle in a differing environment from exterior conditions or the rest of the vehicle requires a multi-environment enclosure. This includes two components; the sealed space itself and the equipment to establish and control that environment. This equipment consumes one additional Space for every 20 Spaces in the multi-environment enclosure, or a minimum of one Space. All multi-environment spaces require a powered vehicle.

Multi-environment spaces may include an airlock or grav plating but these are purchased and accounted for separately. At introduction, the multi-environment enclosure can only control temperature and humidity, allowing for refrigeration, heating or a water-filled environment. At TL9 this enclosure becomes truly multi-environment, capable of supporting differing atmospheric composition (even corrosive atmospheres). A TL11, the enclosure can support an insidious environment but only for

Medical Bay	TL	Effect	CP	Spaces	Cost
Medical Bay: Bed	5	Allows recovery and administration of medicine	1	2	Cr2000
Medical Bay: Cabinet	5	Storage for medikit and medical supplies	0	2	Cr5000
Medical Bay: Operating Table	5	Allows surgery on patients	0	8	Cr20000
Medical Bay: Sterile	5	Per Space to provide a sterile environment	0	—	+Cr1000

Multi-Environment Enclosure	TL	Effect	Cost per Space
Basic	5	Temperature, humidity, water	Cr100
Improved	9	Pressure, taint, exotic and corrosive atmospheres	Cr200
Advanced	11	Insidious atmosphere	Cr500

Multi-Environment Equipment	TL	Effect	Cost per Space*
Basic	5	Temperature, humidity, water	Cr1000
Improved	9	Pressure, taint, exotic and corrosive atmospheres	Cr2000
Advanced	11	Insidious atmosphere	Cr5000

* This is Cost per Space consumed by equipment at one Space per 20 spaces of multi-environment enclosure, one minimum.

a cumulative number of days equal to the Tech Level of the enclosure, after which the seals begin to fail, potentially spreading the environment to the rest of the vehicle. Refurbishment of an insidious environment enclosure costs 5% of the enclosure's Cost if refurbishment occurs before a failure and 10% if a failure has occurred. A breach of the insidious environment from damage will flood the vehicle with the insidious atmosphere.

SELF-SEALING FUEL TANK

Powered vehicles either use fuel directly for their engines or liquids to provide engine cooling or transfer of energy. A Critical Hit result of 'Fuel' can cause these tanks to leak or explode. A self-sealing fuel tank uses multiple layers, foam or other methods to inhibit fuel loss and limit the chance of a catastrophic explosion. A vehicle with a self-sealing fuel tank can subtract one Severity Level from any Fuel Critical Hit, ignoring those of Severity 1 entirely. A self-sealing hull (see page 64) will also provide this benefit without consuming any Spaces.

	TL	Spaces*	Cost per Vehicle Space
Self-Sealing Fuel Tank	5	5%	Cr500

* A self-sealing fuel tank consumes a minimum of one Space.

TRAINING FACILITY

This is a general training area for students, instructors and practitioners to learn, teach or practice their skill. This can include everything from a gymnasium to a lecture room, to a simulated environment. Use of a training facility can lower training times by 10% or allow DM+1 on EDU rolls for learning a skill.

	TL	Spaces	Cost
Training Facility (per user)	1	8	Cr400000

UNREP SYSTEM

This system replenishes and resupplies vehicles while in motion and is vital to the function of vehicles at sea or in remote locations. The system includes fuel hoses, cargo transfer tubes and other gear designed to move ordnance, fuel and freight between two vehicles. Note that only the delivery vehicle is required to carry the UNREP system.

Each Space dedicated to the system allows the transfer of 20 Spaces of fuel, cargo or ordnance per hour. Vehicles with standard fuel requirements are assumed to have 20% of their Spaces dedicated to fuel, so a 20 ton fighter jet, attached to a tanker with a 10 Space UNREP system would require 4 Spaces of fuel to replenish. An UNREP system requires a powered vehicle.

	TL	Effect	Cost per Space
UNREP system	5	Each Space transfers 20 Spaces/hour	Cr125000

VAULT

A vault is an armoured chamber inside a vehicle designed to survive damage or secure valuables. A vault is always equipped with whatever collision protection is available at the vehicle's Tech Level, a Formidable (14+) complexity lock of the vehicle's Tech Level and is armoured to the maximum level for that Tech Level – excluding AFV armour. If a vault is in a cargo area subject to a Critical Hit, it ignores the first Severity 1 hit and reduces the Severity of subsequent Critical Hits by one level.

Additional options include life support (able to support anyone inside the vault for four days including vacuum, hostile environment and radiation protection) and reinforced (providing triple the armour protection available at the vault's Tech Level, matching AFV protection limits even if the vehicle is not an AFV). If a reinforced vault is in an area subject to a Critical Hit, it ignores the first Severity 1 or 2 hit to that area and reduces the Severity of subsequent Critical Hits by up to two levels.

Life support and reinforced vault do not consume additional Spaces but must be installed for the entire vault volume to be effective. Each Vault can house one occupant or 250 kilograms of material or other options on a per-Space basis. Larger sophonts require larger vault Spaces per occupant.

A vault has enough battery power to sustain short term life support and does not require a powered vehicle. A large enough vault could include other items, such as a longer-term power supply, better life support or even a medical facility or low berths.

Vault	TL	Effect	Cost per Space
Vault	3	Collision protection, Formidable lock, armour	Cr50000
Vault Life Support	7	Short term life support, vacuum, hostile and radiation protection	+Cr20000
Reinforced Vault	5	Triple armour protection	+Cr50000

WORKSHOP

A workshop can be used to repair broken equipment and fabricate new items. It is a space for doing work, with workbenches and cabinets for storing tools, but it does not include toolkits or fabricators. Each workshop can allow a single Traveller to use the Mechanic skill for tasks in the workshop or on and around the vehicle with DM+2. Workshops in or adjacent to hangars or construction bays also provide this bonus to work within the bay. Workshop space does not allow for additional mechanics to work but expands the size of the work area to allow for installation of larger fabricators or other equipment.

A workshop is available at TL1+ and equipped to allow work on equipment of the same or lower Tech Level. It does not technically require power at TL4 or less but metalwork requires a furnace or other heat source, and the workshop must have access to power for work on electronics or powered components. The workshop and workshop spaces can include the clean room option (see page 78) to allow open fabrication work without penalty.

	TL	Spaces	Cost
Workshop	1	12	Cr90000
Workshop Space	1	1	Cr1000

OTHER OPTIONS

No listing of options and items can be complete. A vehicle can potentially install options and items from other *Traveller* publications or items created for an adventure or campaign.

SPACECRAFT OPTIONS

Many options from the *Traveller Core Rulebook's* Spacecraft Construction chapter and the Spacecraft Options section of *High Guard* have been included here. If an option exists here that contradicts something in the *Traveller Core Rulebook* or *High Guard*, then for the purposes of installation in vehicles, this book should be used.

Many spacecraft options can also be installed in vehicles with the Referee's approval. The general rule for vehicle installation is that an item requiring one ton in a spacecraft requires four Spaces in a vehicle. Surface coatings will cover a 4-Space vehicle at the same cost as a surface coating covering a spacecraft ton. Costs can also be lower by as much as four or five times to allow less robust versions of options if they are not intended for the rigours of space travel or, in the case of structures, any movement at all. Finally, any spacecraft option requiring power only functions in a vehicle with a nuclear power plant and power requirements should be computed with the assumptions that a Space is a quarter displacement ton, and that fractional power requirements are rounded up.

CENTRAL SUPPLY CATALOGUE

Items detailed in the *Central Supply Catalogue* can be installed in a vehicle. Surface coatings and similar items detailed in this book should be used instead of similar items in the *Central Supply Catalogue*.

ROBOT HANDBOOK

Individual options listed in the *Robot Handbook* are generally not compatible with vehicles, except for brains and the equipment to control them as noted in the Automation chapter of this book. Larger variants of most systems are available as options for vehicles and these should be used for vehicles, especially where conflicts exist.

AUTOMATION

At lower Tech Levels all of a vehicle's functions require mechanical power and the control and assistance of its occupants in the operation of systems. Simple interior features may only require mechanical or simple electrical interfaces but as technology matures, more and more of a vehicle's components are subject to automatic control, ranging from simple hardwired computer chips to full-blown remotely operated systems or vehicles that are, in effect, robots.

COMPUTERS

By TL7 most vehicles have microprocessors embedded in various components and by TL8 they not only have dozens of specialised computers but usually a general-purpose computer to act as an interface. Such Computer/0 devices are a novelty at TL7 but considered standard equipment and subsumed into the price of any powered vehicle by TL8.

General-purpose computers in vehicles are equivalent to personal portable computers but have integration to the vehicle's systems and many computerised sub-components, making them twice as expensive and not directly replaceable by a portable unit.

A Computer/0 running Interface software is zero Cost standard equipment at TL8+. More advanced computers decrease in cost at higher Tech Levels with an interval of one TL as indicated in the Tech Level Stages table on page 57 and become available at zero Cost as the TL increases.

Computer	TL	Cost	Free at TL
Computer/0	7	Cr1000	8
Computer/1	8	Cr500	11
Computer/2	10	Cr1000	13
Computer/3	12	Cr2000	16
Computer/4	13	Cr3000	18
Computer/5	14	Cr10000	19
Computer/6	15	Cr15000	20
Computer/7	16	Cr20000	21

SHIP COMPUTERS

A vehicle can instead install a larger computer such as those available for spacecraft, as indicated in the *Traveller Core Rulebook* on page 181 and *High Guard* on page 20. While a spaceship is usually large enough for the volume of the computer to be inconsequential, this is not true for vehicles. A ship computer consumes one Space for every 10 Bandwidth (rounding up). Ship computers do not decrease in Cost or Spaces as Tech Levels increase.

FIBRE OPTICS

Any computer can be protected against EMP, radiation or ion weapons by using hardened fibre-optic connections. This adds 50% to the cost of the computer and is indicated by adding the '/fib' suffix to the computer rating. If the computer was free, then the /fib option costs Cr100.

SOFTWARE

A vehicle's computer can run any general-purpose software and provides a diagnostic interface to its systems and equipment. It cannot act as an autopilot by using Expert software alone, as the autopilot (see page 58) is an integrated system with sensors, direct control interfaces and usually communications links to local traffic control and possibly other vehicles. If a properly programmed computer is connected to a drone interface and drone actuators, it could perform autopilot functions.

Additional programs are useful for controlling other vehicle options. In some cases, high-Bandwidth software will require a vehicle to install a ship's computer.

BATTLE NETWORK

The Battle Network package enables a vehicle to hand off target sensor detection data to vehicles or gun emplacements within the range of the software. This range is also limited by the Battle Network computer's vehicle sensors effective range to a target and the hand-off vehicle's range; both transmitter and receiver must have the target within range. A vehicle can also transfer target data to the Battle Network's computer and that central computer can retransmit it to other vehicles. Each transfer requires a combat round, so if a remote vehicle transfers data to the Battle Network during one round, the software disseminates the data in the following round and in the round after that, all vehicles within range will have received the sensor data and can attack the target.

DRONE AND SWARM CONTROL

Drone and Swarm Control software performs functions similar to the drone and swarm controllers listed in the Drones section on page 95 and require links to appropriate transceivers.

WEAPONRY

Weaponry software allows a computer to autonomously use any weapons mount that can be operated remotely. This includes any mount with at least a basic fire control system but it will not allow a weapon to be reloaded unless it also has an autoloader. Weaponry software runs on a central computer and can control one mount per instance of the software. All bonuses from the fire control system still apply to the weapon mount.

More advanced Weaponry software can either operate a single weapon mount with its indicated skill, one system at skill level 0 and one additional weapon mount at skill level 0 per rating, or it can use its rating to do some of each. For example, Weaponry/3 could operate one system at DM+3, a total of 4 systems at skill level 0, or one system at skill level 2 and a second at skill level 0.

HULL PROGRAMMING INTERFACE

Software to allow custom displays for multi-chromatic and holographic hulls allows the user to create or modify a display pattern. The hulls themselves come with standard camouflage patterns and simple colour scheme or text modifications but custom images, conditional effects and other advanced features require Hull Programming Interface (HPI) software. Depending upon the effect desired, Art, Tactics or some other skill may be required to make an effective display.

Battle Network Software

Software	Bandwidth	TL	Capability	Cost
Battle Network/0	3	12	Limited to 1,000km	MCr1
Battle Network/1	5	12	Limited to 10,000km	MCr5
Battle Network/2	10	14	Limited to 25,000km	MCr10

Drone Control Software

Software	Bandwidth	TL	Capability	Cost
Drone Control/1	1	11	Control DM +0	Cr2000
Drone Control/2	2	12	Control DM +1	Cr5000
Swarm Control/1	1	11	1 max tasks, 0 max skill	Cr15000
Swarm Control/2	2	12	2 max tasks, 1 max skill	Cr30000
Swarm Control/3	3	13	3 max tasks, 2 max skill	Cr60000
Swarm Control/4	4	14	4 max tasks, 3 max skill	Cr120000

Weaponry Software

Software	Bandwidth	TL	Capability	Cost
Weaponry/0	1	8	Control one weapon mount at skill 0	Cr100000
Weaponry/1	1	9	See description	Cr500000
Weaponry/2	2	10	See description	MCr1
Weaponry/3	3	11	See description	MCr2
Weaponry/4	4	13	See description	MCr4
Weaponry/5	5	15	See description	MCr8

Hull Progrmme Interface Software

Software	Bandwidth	TL	Capability	Cost
HPI Holographic Display	3	10	Custom displays	Cr5000
HPI Multi-chromatic Display	2	12	Custom displays	Cr2000

POINT DEFENCE

An anti-missile system (see page 73) can defend a vehicle against attack by projectile weapons. Point Defence software enhances and extends that umbrella to protect vehicles, structures and personnel within a specified radius and to twice that radius with a relative DM-2. The anti-missile system is still limited to increasingly negative DMs for all projectiles it attempts to intercept in a single combat round, regardless of their target.

SALVO SOLUTION

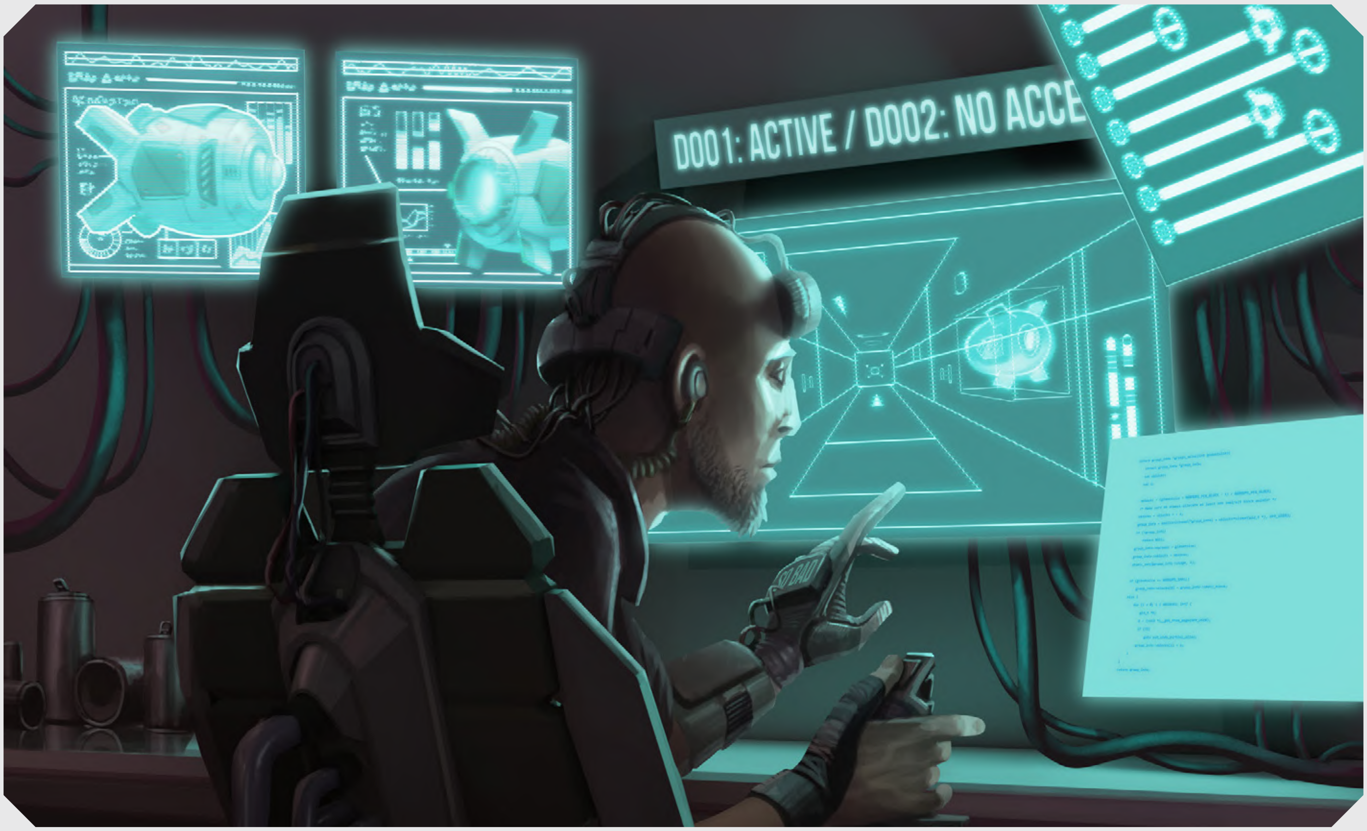
Using complex calculations to mark trajectories of entire salvos of smart missiles and artillery shells, the Salvo Solution package optimises these attacks to devastating effect. All smart missile and artillery salvoes fired by the vehicle gain a DM to their attack rolls equal to the Salvo Solution score (so, Salvo Solution/2 grants DM+2 to all smart missile and artillery attack rolls). Salvo Solution does not aid unguided, and all weapons participating in a salvo must have a fire control system, but starting with Salvo Solution/2 the software can include nearby units that are in communication with the controlling vehicle for salvoes aimed at the same target.

Point Defense Software

Software	Bandwidth	TL	Capability	Cost
Point Defence/1	2	9	DM+1 to 50 metres	Cr500000
Point Defence/2	3	12	DM+2 to 100 metres	Cr800000
Point Defence/3	5	14	DM+3 to 100 metres	MCr1

Salvo Solution Software

Software	Bandwidth	TL	Capability	Cost
Salvo Solution/1	2	8	DM+1 for computer's vehicle only	Cr500000
Salvo Solution/2	4	10	DM+2 for computer's vehicle + 2 vehicles	Cr600000
Salvo Solution/3	6	12	DM+3 for computer's vehicle + 4 vehicles	Cr800000
Salvo Solution/4	8	14	DM+4 for computer's vehicle + 8 vehicles	MCr1


D001: ACTIVE / D002: NO ACCE

SENSOP

The Sensop package allows the automation of sensor operator work. This allows the package to perform one Electronic (sensors) task in a combat round at the indicated level. Multiple instances of Sensop can run to allow multiple independent tasks to be conducted. The software can operate sensors to detect objects, perform electronic warfare actions using an ECM system, or pass off sensor information in conjunction with Battle Network software. High-level versions of Sensop can also divide tasks among multiple sensors in the same manner as Weaponry software (see page 93).

TACTICAL BATTLE SYSTEM

Tactical Battle System is software displays and simulates data for combined arms operations from the tactical to theatre level, or for a commander coordinating units from a company to an army in size. It runs high-level simulations and makes predictions to advise officers as to the correct course of action. Any Traveller using Battle System gains a DM to Tactics (military) checks equal to the Tactical Battle System score (so, Tactical Battle System/2 grants DM+2).

Sensop Software

Software	Bandwidth	TL	Capability	Cost
Sensop/0	1	8	Perform one Electronic (sensors) task at skill level 0	Cr100000
Sensop/1	1	9	See description	Cr500000
Sensop/2	2	10	See description	MCr1
Sensop/3	3	11	See description	MCr2
Sensop/4	4	13	See description	MCr4
Sensop/5	5	15	See description	MCr8

Tactical Battle Software

Software	Bandwidth	TL	Capability	Cost
Tactical Battle System/1	2	9	DM+1 Tactics (military)	MCr4
Tactical Battle System/2	3	12	DM+2 Tactics (military)	MCr6
Tactical Battle System/3	5	15	DM+3 Tactics (military)	MCr9

DRONES

A drone is a remotely controlled vehicle with no local operator. Instead, a remote operator uses the Electronics (remote ops) skill to direct it. To be configured as a drone a vehicle requires a:

- Transceiver system with enough range to communicate back to a base station
- Drone interface
- Actuators aboard the vehicle that allow the drone interface to remotely control all aspects of the vehicle's operation
- Remote operator using a drone console or a drone control helmet

Item	TL	Effect	Cost
Drone Interface	6	Allows control of drone	Cr100
Drone Actuators	6	Allows drone to control the vehicle	Cr50 per vehicle Space

DRONE CONTROL CONSOLE

The remote drone 'driver' can control the drone either with a console or Drone Control software (see page 93) connected to a transceiver. A drone controller installed on another vehicle does not consume Spaces, although the operator needs a place to sit or stand.

Drone Control Console	TL	Mass (kg)	Control DM	Cost
Primitive	5	10	-4	Cr1000
Basic	7	2	-2	Cr2500
Improved	8	2	0	Cr1000
Enhanced	10	0.5	0	Cr1000
Advanced	11	0.5	+1	Cr5000

DRONE CONTROL HELMET

A drone control helmet allows a user without augments to operate a drone by thought. It fits over the head and provides neurological inputs that override a user's senses and movements, instead receiving senses from the drone and transmitting commands to it. While it provides a virtual reality experience, it does not allow full presence in the sense of an avatar. Effective use of a drone control helmet does not require the Electronics (remote ops) skill but benefits from it. The drone control helmet provides all the features of an advanced drone control console with a 50-kilometre transceiver and can connect to an external transceiver for additional range. For every 5,000 kilometres of distance to the drone, the control DM decreases by -1.

	TL	Mass (kg)	Control DM	Cost
Drone Control Helmet	11	3kg	+1	Cr50000

OTHER OPTIONS

Note that drones can receive all options that other vehicles have, such as advanced control systems and autopilots (the latter allowing the drone to travel from point-to-point without requiring constant attention from the operator). A vehicle can also be controlled as an avatar (see *Robot Handbook*, page 95). Any of these control methods can also be used by an operator inside the vehicle itself.

An operator can control a larger number of drone vehicles with a swarm controller console or Swarm Control software.

SWARM CONTROLLER CONSOLE

A swarm controller console is an integrated device allowing an operator to command a swarm of drones, or to command a group of identical vehicles conducting synchronised tasks from cross-country flying to construction to mining to storming a fortress – although as a mob, not a coordinated military force.

The console includes a specialised computer to run Swarm Control software through an Expert system, allowing an unskilled individual to verbally control the console to issue commands for the swarm. A multi-channel wireless data link and a 50-kilometre multi-channel transceiver is integrated. The console can also be operated as an Improved drone control interface with effective Electronics (remote ops) 0 for an unskilled individual or at full level for a skilled operator. Drones can be controlled up to 50 kilometres distant by default and at longer ranges by linking to a longer-range transceiver. An external multichannel transceiver to extend this distance requires an Enhanced or more sophisticated transceiver.

More capable swarm controllers are available at higher Tech Levels as computers and software improve.

Limitations on the number of drones controlled assume independent tasks, such as construction or combat. To control flight, even in choreographed formations, requires only one task, and can be performed with a Basic console communicating with an effectively unlimited number of drones. More sophisticated tasks can be done by multiple swarms in tandem. The maximum number of tasks for a controller is equal to the different skills a controller can coordinate for a swarm to perform simultaneously, with the indicated maximum skill level that the swarm controller can convey to a swarm. If controlling single drones, the drone number indicates the maximum number of drones the swarm controller can manage at once, with the drones unrestricted in whatever tasks they are performing.

Swarm Controller Console	TL	Capability	Mass	Cost
Basic	8	1 task, skill level 0 or 1 drone	10kg	Cr20000
Improved	12	2 tasks, skill level 1 or 2 drones	6kg	Cr50000
Enhanced	13	3 tasks, skill level 2 or 4 drones	4kg	Cr100000
Advanced	14	4 tasks, skill level 3 or 8 drones	2kg	Cr200000

ROBOTS

Much more than an autopilot, a robot brain can autonomously control a vehicle, turning it into a giant robot. As with an autopilot, this requires more than just the computer. Vehicle brains are described in detail in the *Robot Handbook* but some example robots are included here.

Unlike an autopilot, a robot with a vehicle brain interface can control every aspect of a vehicle from doors to the actions of manipulators to actions in direct violation of traffic control systems. A robot can wander from roads onto rough terrain and perform actions and manoeuvres an autopilot would not contemplate.

VEHICLE BRAIN INTERFACE

A vehicle brain interface is required to provide full haptics to the robot brain and allow the robot to 'be' the vehicle. These interfaces provide direct control to the vehicle's systems and cost Cr1000 per Space of the vehicle if installed during vehicle construction.

Item	TL	Cost per vehicle Space
Vehicle Brain Interface	10	Cr1000

CHAUFFEUR, BASIC

The first iteration of a fully autonomous vehicle, the basic chauffeur can drive autonomously under most conditions. Manufactured by the millions, it is inexpensive and on some high Law Level worlds, mandatory. It is entirely dependent on the vehicle's systems or a transceiver link to traffic control for navigation and has little common sense, interpreting commands literally and obeying all traffic regulations to the point of irritation. All off-road travel is conducted in a 'careful' mode, reducing the vehicle's Speed Band by one, although to no slower than Idle but granting DM+2 to any checks. Its drone interface allows remote control of the vehicle by an authorised user.

Item	TL	Skills	Cost
Chauffeur, Basic	8	Vehicle (specific) 1	Cr12000

Robot	Hits	Locomotion	Speed	TL	Cost
Chauffeur, Basic	1	None	0m	8	Cr12000
Skills	Vehicle (specific) 1				
Attacks	none				
Manipulators	none				
Endurance	216 hours				
Traits	Armour (+2), Small (-4)				
Programming	Basic (locomotion) (INT 3)				
Options	Auditory Sensor, Drone Interface, Spare Slot x3, Transceiver 50km (improved), Visual Spectrum Sensor, Voder Speaker, Wireless Data Link				

CHAUFFEUR, IMPROVED

Benefitting from improvements in robot brain capabilities, the improved chauffeur is both cheaper and better than the introductory version. It still lacks the ability to improvise or think outside the box but is capable of off-road travel at normal speeds and handling most obstacles without intervention.

Item	TL	Skills	Cost
Chauffeur, Improved	10	Vehicle (specific) 2	Cr6000

Robot	Hits	Locomotion	Speed	TL	Cost
Chauffeur, Improved	1	None	0m	10	Cr6000
Skills	Vehicle (specific) 2				
Attacks	none				
Manipulators	none				
Endurance	216 hours				
Traits	Armour (+3), Small (-4)				
Programming	Basic (locomotion) (INT 4)				
Options	Auditory Sensor, Drone Interface, Spare Slot x3, Transceiver 50km (enhanced), Visual Spectrum Sensor, Voder Speaker, Wireless Data Link				

CHAUFFEUR, ADVANCED

Achieving even greater agility, the advanced chauffeur is no smarter than the improved model but handles itself better in unusual or unexpected conditions.

Item	TL	Skills	Cost
Chauffeur, Advanced	12	Vehicle (specific) 3	Cr9000

Robot	Hits	Locomotion	Speed	TL	Cost
Chauffeur, Advanced	1	None	0m	12	Cr9000
Skills	Vehicle (specific) 3				
Attacks	none				
Manipulators	none				
Endurance	216 hours				
Traits	Armour (+4), Small (-4)				
Programming	Basic (locomotion) (INT 4)				
Options	Auditory Sensor, Drone Interface, Spare Slot x3, Transceiver 50km (enhanced), Visual Spectrum Sensor, Voder Speaker, Wireless Data Link				

COMBAT VEHICLE BRAIN, BASIC

The basic combat vehicle brain, or CVB, is the core of the lowest Tech Level fully autonomous fighting machine. With a Hunter/Killer brain, autopilot, fire control system and navigation system built into its tiny box, with proper programming, it is usable on anything from a robot-sized fast-moving vehicle to a fighter jet to a lumbering heavy tank. If the vehicle has its own systems for reconnaissance and communications, it can utilise these but is limited to its own autopilot and fire control skills, which are the best available at TL8. If installed in a robot, the basic CVB occupies two Slots and includes the robot's brain.

Item	TL	Skills	Cost
Combat Vehicle Brain, Basic	8	Navigation 1, Recon 0, Tactics (military) 2, Vehicle (specific) 1, Weapon (specific) 2	Cr75000

Robot	Hits	Locomotion	Speed	TL	Cost
Combat Vehicle Brain, Basic	1	None	0m	8	Cr75000
Skills	Navigation 1, Recon 0, Tactics (military) 2, Vehicle (specific) 1, Weapon (specific) 2				
Attacks	none				
Manipulators	none				
Endurance	216 hours				
Traits	Armour (+2), Small (-4)				
Programming	Hunter/Killer (tactical) (INT 3)				
Options	Auditory Sensor, Autopilot (improved), Drone Interface, Fire Control System (improved), Navigation System (basic), Transceiver 50km (improved), Voder Speaker, Wireless Data Link				

COMBAT VEHICLE BRAIN, IMPROVED

By TL10 automation technology is improved enough to provide a more capable CVB. The improved version of this brain is the same small form factor as its predecessor and uses an upgraded Hunter/Killer brain but the brain's increase in general intelligence is less important than improvements in autopilot, fire control and navigation. This box of a robot chassis requires no Spaces on a vehicle but two Slots if installed in a robot as its brain and control system.

Item	TL	Skills	Cost
Combat Vehicle Brain, Improved	10	Navigation 2, Recon 0, Tactics (military) 2, Vehicle (specific) 2, Weapon (specific) 3	Cr87000

Robot	Hits	Locomotion	Speed	TL	Cost
Combat Vehicle Brain, Improved	1	None	0m	10	Cr87000
Skills	Navigation 2, Recon 0, Tactics (military) 2, Vehicle (specific) 2, Weapon (specific) 3				
Attacks	none				
Manipulators	none				
Endurance	216 hours				
Traits	Armour (+3), Small (-4)				
Programming	Hunter/Killer (tactical) (INT 4)				
Options	Auditory Sensor, Autopilot (enhanced), Drone Interface, Fire Control System (enhanced), Navigation System (improved),Transceiver 500km (improved), Voder Speaker, Wireless Data Link				

COMBAT VEHICLE BRAIN, ADVANCED

The TL12 version of the CVB features the most advanced Hunter/Killer brain possible. Improved electronics make it more capable than most crewed vehicles, especially with the targeting heuristics of its advanced fire control system. Continued miniaturisation leaves the advanced CVB with one spare Slot, which, ironically, is sometimes occupied by an avatar controller. This odd combination requires an advanced brain, increasing overall costs and the loss of Hunter/Killer tactical insight, but the controller continues to benefit from the hardwired autopilot, fire control and navigation systems. As with less advanced CVBs, the advanced version requires no vehicle Spaces. Even if the spare Slot compartment is removed, the advanced CVB still requires two Slots if installed in a robot.

Item	TL	Skills	Cost
Combat Vehicle Brain, Advanced	12	Navigation 3, Tactics (military) 2, Vehicle (specific) 3, Weapon (specific) 4	Cr150000

Robot	Hits	Locomotion	Speed	TL	Cost
Combat Vehicle Brain, Advanced	1	None	0m	12	Cr150000
Skills	Navigation 3, Tactics (military) 2, Vehicle (specific) 3, Weapon (specific) 4				
Attacks	none				
Manipulators	none				
Endurance	324 hours				
Traits	Armour (+4), Small (-4)				
Programming	Hunter/Killer (tactical) (INT 4)				
Options	Auditory Sensor, Autopilot (advanced), Drone Interface, Fire Control System (advanced), Navigation System (enhanced), Spare Slot x1,Transceiver 5,000 km (enhanced), Voder Speaker, Wireless Data Link				

TOUR GUIDE

The tour guide is a control panel replacement for any vehicle, designed to transform it into an automated sight-seeing platform. The robot removes all manual control and replaces it with a screen and small internal holographic projector, which allows the robot to give a running commentary with visual effects as it takes passengers on a journey to a tourist attraction or landmark. A built-in autobar and autochef allows it to prepare refreshments along the route but it has limited storage capacity, relying on cargo capacity or containers to carry supplies. The tour guide is a sophisticated robot, able to respond intelligently to queries from passengers and tailoring a tour to their interests while carrying on a pleasant conversation.

The Tour Guide requires no Spaces if placed in a vehicle but occupies 16 Slots in a robot. It provides 2 CP to a vehicle.

Item	TL	Skills	Cost
Tour Guide	12	Carouse 1, Navigation 2, Profession (tour guide) 2, Steward 1, Vehicle (specific) 2	Cr50000

Robot	Hits	Locomotion	Speed	TL	Cost
Tour Guide	12	None	0m	12	Cr50000
Skills	Carouse 1, Navigation 2, Profession (tour guide) 2, Steward 1, Vehicle (specific) 2				
Attacks	none				
Manipulators	none				
Endurance	324 hours				
Traits	Armour (+4), Small (-1)				
Programming	Advanced (INT 9)				
Options	Auditory Sensor, Autobar (improved), Autochef (improved), Autopilot (enhanced), Drone Interface, External Power, Holographic Projector, Navigation System (improved), Video Screen (advanced), Storage Compartment (1 Slot refrigerated), Transceiver 5,000 km (enhanced), Video Screen (advanced), Voder Speaker, Wireless Data Link				

WEAPONS

A vehicle can carry one or more weapons with a limit of up to 100 kilograms per vehicle Space. If a vehicle exceeds this, its maximum and cruise Speed Bands are reduced by one. A vehicle (including a structure) cannot carry more weapons than 250 kilograms per vehicle Space. This includes partially or completely external weapons such as those in turrets or on hardpoints.

Weapons can be attached to a vehicle using several mounts. A gunner uses weapons with the assistance of fire control systems and, for large vehicles with many weapons, fire directors. The operator of the vehicle or an electronic control system may serve as the gunner and some weapons require more than one crewmember to operate and load them.

For every 250 kilograms or fraction thereof, a weapon consumes one Space. Depending upon the mount type, some or all of these Spaces must be accounted for when calculating the total Spaces in a vehicle. The exception to this is for identical weapons in the same mount, which total their mass together for Space purposes. For example, if a bay held four 60-kilogram missiles, it would only require 1 Space. If the mass of the combined weapons increased beyond 250 kilograms, they would consume two Spaces and so on.

Weapons are assumed to be partially or entirely external to the vehicle. This affects the Space requirements for certain mounts, which do not require all their Spaces to be consumed within the vehicle.

Other mounts are adjacent to the surface. Some large vehicles might even have internal weapons for defence of a section of the interior. In those cases, weapon and mount are completely internal.

MOUNTS

Before a weapon can be attached to a vehicle, a mount must be purchased and installed. Each has its own benefits and features, although not every mount is suitable for every weapon. A single mount may contain more than one weapon but they must be of the same type, linked (see page 104) and share the same fire control system (see page 104).

Weapon mounts include fixed mounts, external hardpoints, bays, exposed ring or pintle mounts and armoured turrets. Note that the terms ‘fixed mount’ and ‘hardpoint’ have different meanings for vehicles than for spacecraft.

MOUNT CREWS

Some mounts and their attached weapons require crew to fire, load or otherwise operate them. These crewmembers are referred to as gunners and loaders.

With multiple linked weapons, a gunner or team required to fire a single instance of the weapon can fire all linked weapons in that mount.

Many large weapons require a large crew of gunners and loaders, especially at lower Tech Levels. The weapon typically fires with the skill level of the team leader. If a weapon crew is shorthanded, the weapon can still fire, assuming it has at least one gunner; for each missing gunner, the weapon suffers DM-1 to attack rolls, to a maximum DM-6. A gun team can alleviate some of this penalty by spending one full round in preparation to fire for each missing gunner, over time eliminating all but one DM-1. For each missing loader, reloading takes twice as long.

If a weapon requires one or more loaders, then each weapon in the mount requires a separate team of them but one autoloader (see page 103) mechanism fed from a common ammunition store can reload all identical weapons in a mount.

FIXED MOUNT

A fixed mount is a rigid support for a weapon, with no ability to traverse or change aiming point relative to the vehicle. Most fixed mounts face forward and are activated by the vehicle operator, although there is no mechanical reason why they cannot be mounted in any direction.

Fixed mounts require one Space per 250 kilograms of weapon installed but have no additional Cost. However, a fixed mount's firing direction must be specified upon installation and cannot be changed, nor can the firing point be aimed without changing the orientation of the vehicle.

HARDPOINT

A hardpoint is an external mounting usually used for one-shot ordnance such as bombs and missiles, or attached smaller vehicles such as drones. The main benefit of hardpoints is that any weapons mounted upon them do not consume Spaces inside the vehicle.

Hardpoints cost Cr2000 per Space of the weapon they are designed to hold. Weapons mounted in hardpoints might negatively impact the stealth capabilities of a vehicle (see page 61) and do not benefit from its environmental or armour protection.

AUXILIARY FUEL TANKS

Another use of a hardpoint is to attach auxiliary fuel tanks to vehicles, usually aeroplanes, to extend their Range. An auxiliary fuel tank is carried externally like other ordnance and can be retained or discarded when empty. They are considered part of a vehicle's 'weapon' load, which has a limit of 100 kilograms per vehicle Space. The fuel tank itself has an additional cost.

	TL	Cost per Space
Auxiliary Fuel Tank	5	Cr500

To simplify calculations of the effective Range of a vehicle with auxiliary fuel tanks, the following can be used to cover the entire sortie. This assumes the tank effectively increases the size of the vehicle for the entire sortie – for the purpose of Range only – whether the tank is discarded or not.

Added Range Modifier (%) =

$$\frac{\text{Auxiliairy Fuel Tanks spaces x 2.5}}{\text{(Total Vehixcle Spaces + Auxiliairy Fuel Tank Spaces)}}$$

For example, a 20-Space vehicle with a Range of 1,000 kilometres can install 20 × 100 kilograms, or 2,000 kilograms of weapons, the equivalent of 8 Spaces. If 5 of those Spaces were used to install an auxiliary fuel tank, the modified range is 5 × 2.5 ÷ (20 + 5) = 0.5, meaning range is extended by 50% to 1,500 kilometres.

Auxiliary fuel tanks can be removed from a hardpoint and replaced with other ordnance after a mission is complete and can be used again. They may be discarded in the field, if necessary.

PINTLE MOUNT

A pintle mount is an external post with a weapon mounted upon it. It allows the weapon to pivot across a 90° firing arc but requires a gunner or automated fire control system. Unless equipped with a gun shield, the weapon is not protected by armour and its gunner is half exposed behind the cover of the vehicle's hull. The facing of a pintle mount must be specified at installation.

A pintle mount consumes no Spaces and costs Cr250. It can support a weapon or linked weapons of up to 500 kilograms.

RING MOUNT

A ring mount is usually located by a hatch and allows the weapon to pivot in any direction like a turret. It requires a gunner or automated fire control system. A gunner has only partial cover, similar to that of a pintle mount, unless it is protected by a gun shield.

A ring mount consumes no Spaces and costs Cr750. It can support a weapon or linked weapons of up to 500 kilograms.

GUN SHIELD

A gun shield is a plate of armour offering protection to an exposed pintle- or ring-mount gunner. The gun shield occupies no Spaces but costs as much as one Space of the vehicle's armour for the desired Protection. This protection is limited by the same restrictions as a vehicle of the same Tech Level and cannot apply triple armour even if the vehicle has the AFV trait. The gun shield only provides protection in the direction of the current facing of the weapon.

GUNPORT

A gunport is a slot with an armoured hatch that allows occupants inside a vehicle to attack targets outside with a weapon.

A gunport consumes no Spaces and costs Cr250 for personal weapons such as pistols and rifles. Gunports that support large weapons, such as cannons, cost Cr250 per Space or 250 kilograms of the weapon. A large weapon behind a gunport consumes vehicle Spaces equal to 1 Space per 250 kilograms. Only one weapon is allowed per gunport.

A gunport must specify which facing the gunport fires out of and once selected it cannot be changed. Gunports on vehicles with environmental protection are treated as sealed when not in use. A multi-layered flexible gasket can allow a personal weapon's barrel to protrude out of the vehicle without breaking the seal and a protected window above the port allows a shooter to aim the weapon. These sealed gunports are not available for use in corrosive or insidious environments, or across more than 10 atmospheres of pressure differential. Any weapon performance degradation from the environment is always applied to the weapon firing out the gunport.

BAY

A bay is an internal space designed to hold ordnance such as bombs, missiles and torpedoes, or smaller vehicles such as drones. A bay protects ordnance until it is fired and it consumes one Space per 250 kilograms of weapon, costing Cr2500 per Space. It can fire or drop one weapon every round.

MULTI-BAY

A multi-bay is a bay capable of firing or dropping any number of weapons per round and costs Cr5000 per Space.

TURRET

A turret is an armoured rotating mount capable of firing one or more weapons across a full 360° arc. It can fire in any direction except the face directly opposite that which it is mounted upon. The armour of the turret is equivalent to the most protected face of the vehicle.

A turret consumes one Space for every ton (1,000 kilograms) or four Spaces of weapons it mounts, plus one Space for every gunner or loader, unless the gunners are remote or the loaders are replaced by autoloaders. A turret may also increase its Space allocation to accommodate crewmembers with other duties, such as a commander or a gunner for an external mount on the turret itself.

Turrets can also host additional mounts that operate separately. These are normally fixed, pintle, ring or hardpoints. If additional mounts normally require Spaces, it increases the size of the turret by the Spaces required.

A turret costs Cr20000 for every Space it consumes.

POP-UP MOUNT

Any mount can be concealed within a vehicle until required. This is typically done in order to gain surprise on an enemy or avoid cursory checks for illegal weaponry.

A pop-up mount consumes an additional number of Spaces equal to the original mount and its weapons (minimum of one Space) and costs Cr10000 per Space.

AUTOLOADERS

An autoloader is available at TL6, consuming at least one Space, or 10% the number of Spaces as the weapon (rounding up), and has a Cost of 20 times that of the weapon's Magazine Cost. In weapon mounts with more than one linked weapon, a single autoloader mechanism can feed all weapons. The autoloader removes the need for all loader crew. It contains an additional five magazines worth of ammunition and can link directly to a storage area with more ammunition.

For the Space and Cost of a pop-up mount, the autoloader is considered part of the mount, even on mounts where weapons do not normally consume Spaces.

MODULAR MOUNT

Any mount can be made modular, allowing a variety of weapons to be fitted. This allows a vehicle to change its ‘mission profile’ and become effective against different enemies. A hardpoint is already considered to be modular and does not need this modification.

A modular mount increases the cost of a mount by an additional +50%.

Changing a weapon on a modular mount requires a Routine (6+) Mechanics check (1D minutes, INT or EDU) and might require a crane, heavy manipulator arm or other equipment, depending on the size of the weapon replaced.

AMMUNITION STORAGE

This is an area located next to a weapon system to allow reloads from an autoloader or manual loader crew.

	TL	Cost per Space
Ammunition Storage	1	Cr100

FIRE CONTROL

The use of fire control systems allows weapons to be targeted far more accurately. This can range from simple gyrostabilisation to laser rangefinders and integration of a vehicle’s advanced sensor arrays. However, due to cost and complexity, fire control systems are normally fitted only to a vehicle’s main weapons. Fire control systems are only available for ranged weapons and cannot be used in close combat.

All fire control systems grant the Scope trait for the weapon they are attached to (see page 79 of the *Traveller Core Rulebook*). The simplest fire control system is just a scope, which requires a gunner to use it. A Basic or more sophisticated fire control system allows the gunner to be elsewhere in the vehicle with a remote connection to the weapon mount. Without a scope, direct fire weapons have a maximum effective range of one kilometre, so any installed fire control system will allow a long-range weapon to reach its full potential.

Fire Control Systems

Fire Control System	TL	Attack Roll DM	Cost
Scope	4	+0	Cr50
Basic	6	+1	Cr10000
Improved	8	+2	Cr25000
Enhanced	10	+3	Cr50000
Advanced	12	+4	Cr100000

LINKED WEAPONS

As long as space permits, multiple weapons can be attached to a single mount but they must be of the same type. This is called linking (or sometimes twin-linking, as weapons are often mounted in pairs). When calculating Spaces consumed, linked weapons with an individual mass of 125 kilograms or less can have their masses totalled and then divided by 250, rounding up, to determine how many Spaces they consume. For example, three medium machine guns have a tonnage of 0.05 or 50 kilograms each, a total of 150 kilograms, so they consume only one Space when on a linked mount. If there were six machineguns, totalling 300 kilograms, they would consume two Spaces instead.

If weapons of the same type are linked in this way, only one attack roll is made for all of them. If they successfully hit a target, one damage roll is made for all of them but they add +1 per damage dice for every extra weapon. In the case of Destructive weapons, this bonus is added before the damage is multiplied.

FIRE DIRECTOR

A larger vehicle may have multiple mounts of the same weapon type. By using better scopes, computers and elevation to pinpoint the distance and compute the future location of a moving object, a fire director can aid the firing solutions of an entire battery of weapons (see Battery Fire on page 6). When in use, all these weapons must fire at the same target. A fire director grants the Scope trait to all weapons under its control and fire directors and individual mount fire control systems are additive.

The major limitation of a fire director is that the target must be at least 500 metres away for any bonuses to apply. The guns could still fire as a single battery but would not gain the fire director’s bonus.

Fire Director Systems

Fire Director System	TL	Spaces	Crew	Attack Roll DM	Cost
Basic	6	6	2	+1	Cr100000
Improved	8	4	1	+2	Cr250000
Enhanced	10	2	1	+3	Cr500000
Advanced	12	2	1	+4	MCr1

WEAPON LISTINGS

Military and law enforcement vehicles can carry a variety of weapons, ranging in size from vehicle-mounted versions of personal arms to spacecraft-grade weapons. Some weapons listed here are taken from the *Traveller Core Rulebook* and *Central Supply Catalogue* and others are adapted from *High Guard*. In all cases, weapons have a size expressed in both Spaces and tons. In this case, a ton is defined as 1,000 kilograms, not one spacecraft ton but often these numbers will correspond. Many weapons require a powered vehicle to operate and some of those need the considerable power that only a nuclear system can deliver. The **Power** column marks those requiring Power with 'P' and those requiring fission or fusion (including Fusion+) with 'F'. Those that require multiple Power will have a number after this; for example, F3 if Power 3 is needed. If the vehicle does not have the required Power, it must reduce its Speed Band by one for every point of Power it lacks.

The Rounds per Space entry for each weapon indicates how many rounds, beyond the listed magazine capacity, the weapon can store in dedicated storage space.

Note: The details of some weapons differ from their listing in the *Central Supply Catalogue*. These variations in names and capabilities are specific to vehicles and replace those in other books.

PROJECTILE WEAPONS

Projectile weapons fire dense materials at high velocity into a target. They may use chemical or electric power to accelerate ammunition and are generally divided into two categories; artillery, which fires at an often unseen target using a ballistic trajectory, and direct fire weapons, which fire directly at the target.

Some projectile weapons can use different kinds of ammunition, listed in the Specialised Ammunition section of this chapter. Many have a slow rate of fire, requiring longer than a combat round to reload and ready for the next volley. After the first shot, the reloading process occupies at least some of the crew members for an extended period of time, during which they can perform no other Major Actions.

AMMUNITION STORAGE

By default, a weapon carries one magazine of ammunition. For some large weapons, a magazine is a single round and any additional ammunition requires at least 1 Space of storage or the equivalent Space of the weapon itself for bombs and the like. In most cases with gun-type weapons, ammunition storage assumes that 20 rounds equals 10% of a weapon's Spaces. Weapons that require a powerpack are assumed to be powered by the vehicle's power plant but spacecraft-sized weapons require fusion power plants to provide enough energy.

ARTILLERY WEAPONS

All weapons described here require the Heavy Weapons (artillery) skill to use effectively. All ranges are listed in kilometres. Some, such as bombardment guns, mortars and siege guns, cannot be used in a direct fire attack and have a minimum firing range of one-quarter their listed range. Other artillery weapons can fire directly, using the Heavy Weapons (vehicle) skill, but the guns and their fire control are not designed to be accurate in this role and suffer DM-2 when used in this manner. Unless otherwise stated, artillery weapons can use the variant ammunition types found in the Specialised Ammunition section.

FORWARD OBSERVERS

On the battlefields of the far future, immense and powerful weapons can be deployed against the enemy. However, be they missiles or bombs from fast-flying aircraft, massive shells from artillery, or apocalyptic energy blasts from orbiting spacecraft, they all need eyes on the ground to be delivered accurately and effectively. This is where forward observers come in.

A forward observer is someone who has a direct line of sight to a target and a communications link to a weapon that can attack the target but is otherwise unable to do so independently due to obstruction of its line of sight (artillery weapons), speed of travel (aircraft), or simply being too far away (spacecraft in orbit).

The forward observer makes an Electronics (comms) check (1D rounds, INT). Additional modifiers may be included as if this Electronics (comms) check was an attack roll, including those for battlefield conditions, cover and any other factors the Referee feels are relevant.

This check is then used as the start of a task chain, to be followed by an attack roll by the weapon's operators. The only modifiers applied to this attack roll are from the task chain and skill of the attacker.

If the attack misses the target, roll 1D for each point of negative Effect, then multiply the total by 10 if the attack was from aircraft or artillery and 100 if it were from a spacecraft. This is the number of metres the attack misses by. The Referee can randomly determine in which direction the attack actually lands

BLACK POWDER MORTAR

A primitive short-barrelled smoothbore weapon, the black powder mortar is little more than a very short cannon placed upon a high-angle mount. They are sometimes called 'grasshopper guns' due to their tendency to jump about when firing. They cannot be fired directly at targets. With a full crew this weapon can fire once every five combat rounds.

BOMBARDMENT GUN

These super heavy guns are designed for bombardment of static or slow-moving targets, normally fielded as railway guns, aboard a maritime vessel or as coastal defence weapons. They are unable to hit targets with direct fire or at distances less than one quarter of their range and are extremely slow to reload, with some models requiring many minutes between firing shells. With a full crew, the light, medium or heavy versions of this weapon can fire once every 10, 20 or 200 combat rounds.

DEMOLITION GUN

This is a short-barrelled petard weapon designed to deliver an extremely large explosive charge over a short distance. The demolition gun is normally mounted aboard engineering or assault support vehicles, to demolish fortifications and flatten obstructions. With a full crew this weapon can fire once every five combat rounds.

FIELD GUN

A long-barrelled artillery piece, this gun has a higher muzzle velocity than the equivalent howitzer and can hit targets further away. It is also more capable in the direct fire role, receiving only DM-1 when used for direct fire. A standard artillery piece on many worlds, this gun is often mounted on a vehicle or towed. Some larger versions can handle small nuclear warheads but this is uncommon. With a full crew, the light, medium, or heavy versions of this weapon can fire once every 3, 4, or 10 combat rounds.

HOWITZER

A short-barrelled artillery piece crewed by up to six personnel and usually moved by animal power or towed by a vehicle, the howitzer can deliver shells towards far off targets. It can also fire directly over open sights but there are far better weapons for this role. With a full crew, the light, medium or heavy versions of this weapon can fire once every 3, 4, or 10 combat rounds.

MASS DRIVER

Normally mounted on a vehicle, a mass driver is an advanced tube-based artillery weapon that uses electromagnetic acceleration to hurl its payload. It is somewhat effective for direct fire, suffering only DM-1. With a full crew, the light, medium and heavy versions of this weapon can fire once every 2, 4, or 10 combat rounds.

MESON GUN

Although technically a direct fire weapon (the beam travels in a straight line) and not a projectile weapon, a meson gun's ability to fire through intervening obstacles and the need-to-know distance to a target makes it functionally an indirect fire weapon.

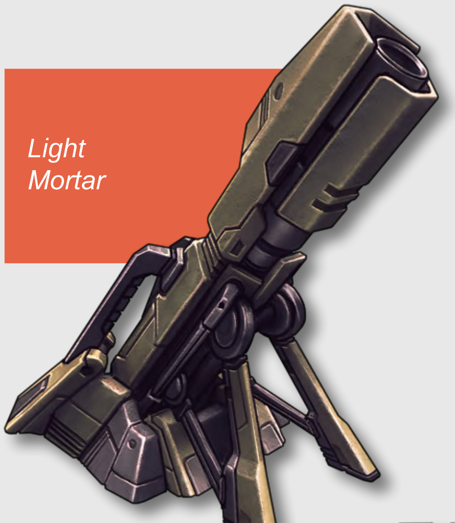
A battlefield-grade meson gun requires a nuclear power plant and can only be mounted in emplacements or on the very largest of vehicles. It is similar in operation to spacecraft-grade meson guns in that the particles it accelerates do not interact with matter until they decay, allowing the weapon to effectively shoot through any obstruction so long as the target's location is known. Meson guns ignore all armour and radiation shielding and are only blocked by meson screens.

MORTAR

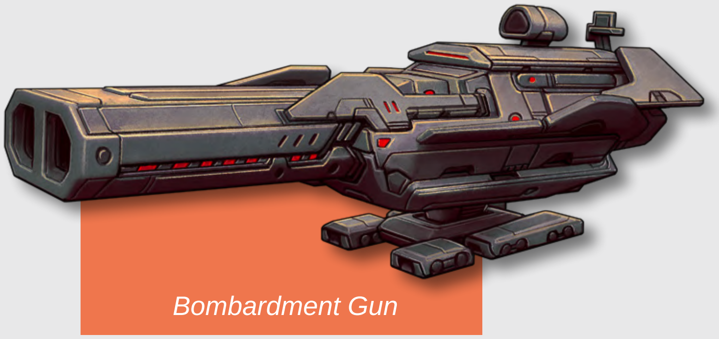
A short-barrelled portable, towed or vehicle-mounted support weapon that launches small explosive shells a respectable distance. These weapons are unable to hit targets with direct fire or at distances less than one quarter of their range. The heavy version of this weapon can fire once every two combat rounds.

SIEGE GUN

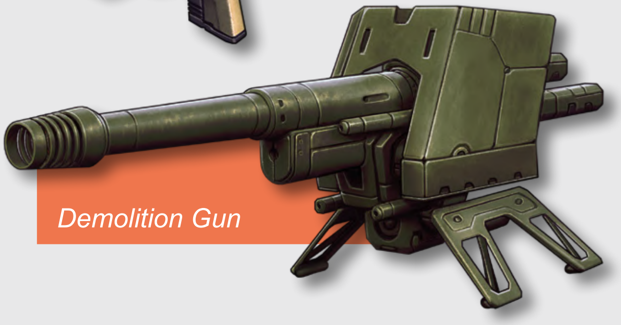
An updated version of the largest artillery piece ever built on old Terra, this 800-mm siege gun must be moved in parts and assembled in its firing position, making it unwieldy and prone to counter-battery fire by lesser, but more practical, pieces. Its awesome warhead can be delivered to a target many kilometres away and a direct hit from its five-ton shell would flatten even a maritime vessel with ease – before detonating. It is extremely slow to reload, requiring 1D hours between firing shells and is unable to hit targets with direct fire or at distances less than one quarter of its range.



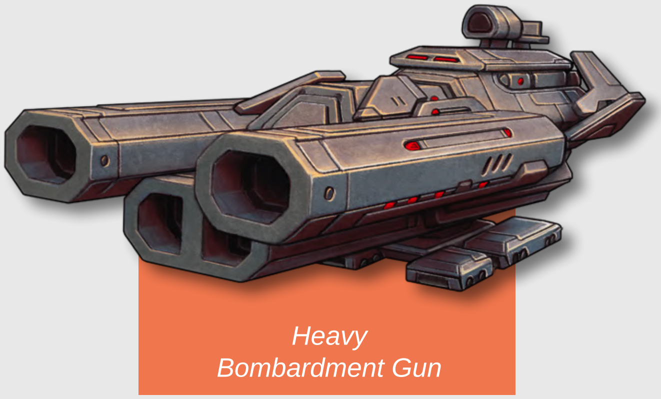
Light Mortar



Bombardment Gun



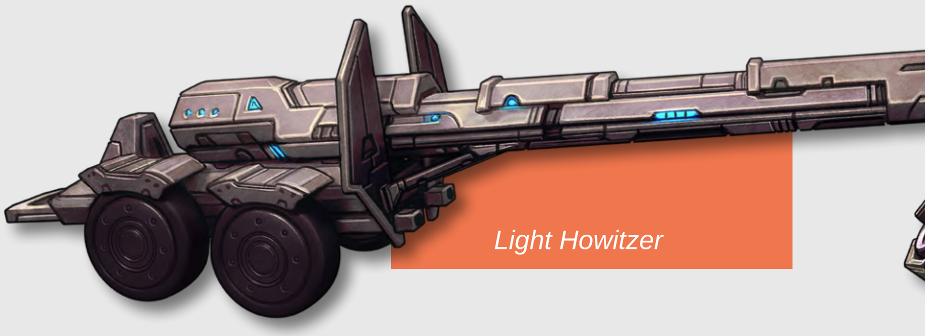
Demolition Gun

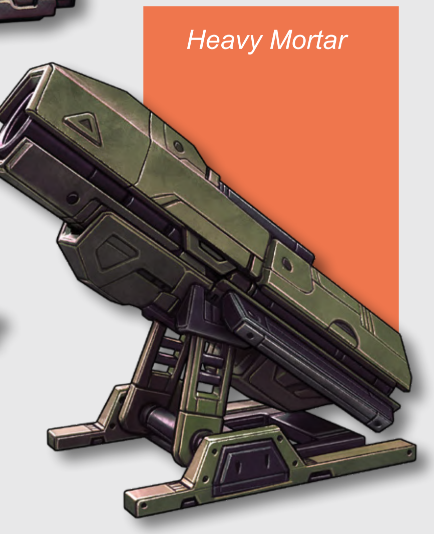


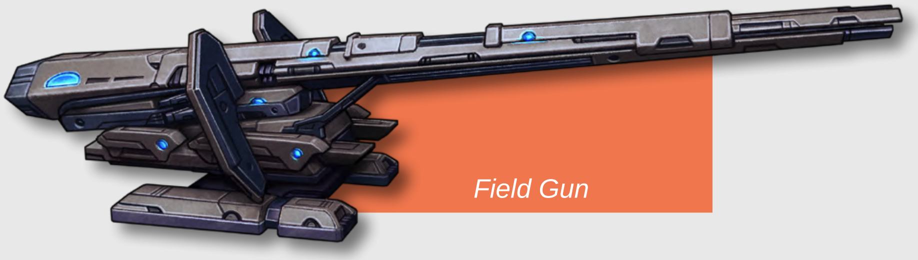
Heavy Bombardment Gun

ARTILLERY WEAPONS

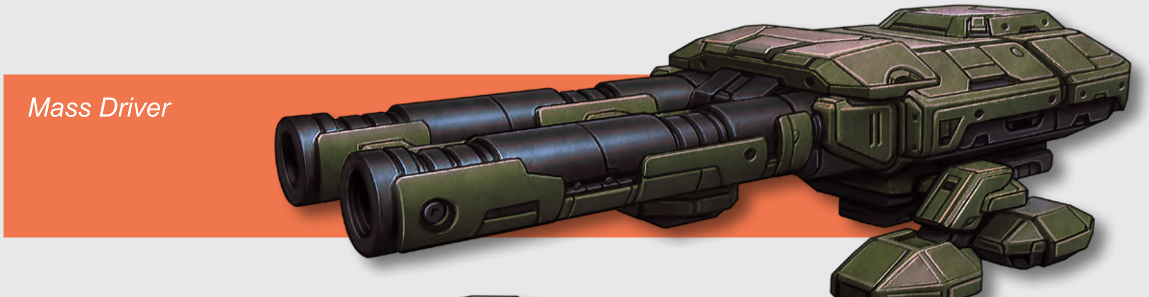
Weapon	TL	Range (km)	Damage	Tons	Spaces	Cost	Power
Black Powder Mortar	2	0.5	6D	0.5	2	Cr2000	—
Bombardment Gun (light)	5	20	1DD	100	400	Cr250000	—
Bombardment Gun (medium)	5	30	2DD	220	880	Cr500000	—
Bombardment Gun (heavy)	5	40	3DD	500	2,000	Cr750000	—
Demolition Gun	6	0.1	1DD	5	20	Cr30000	—
Field Gun (light)	4	9	8D	2	8	Cr75000	—
Field Gun (medium)	5	12	9D	6	24	Cr100000	—
Field Gun (heavy)	5	12	1DD	12	48	Cr120000	—
Howitzer (light)	5	6	8D	2	8	Cr50000	—
Howitzer (medium)	5	9	9D	5	20	Cr75000	—
Howitzer (heavy)	5	9	1DD	10	40	Cr100000	—
Mass Driver (light)	9	20	8D	4	16	Cr300000	P
Mass Driver (medium)	10	40	1DD	7	28	Cr500000	P
Mass Driver (heavy)	11	60	2DD	15	60	Cr800000	P
Meson Gun (light)	15	150	5DD	15	60	MCr20	F
Meson Gun (medium)	15	600	6DD	30	120	MCr30	F
Meson Gun (heavy)	15	1,500	8DD	60	240	MCr40	F
Mortar (light)	4	1	5D	0.03	1	Cr3500	—
Mortar (medium)	4	2	7D	0.1	1	Cr8000	—
Mortar (heavy)	4	3	9D	0.25	1	Cr11000	—
Siege Gun	7	50	6DD	1,200	4,800	MCr2	—


Light Howitzer

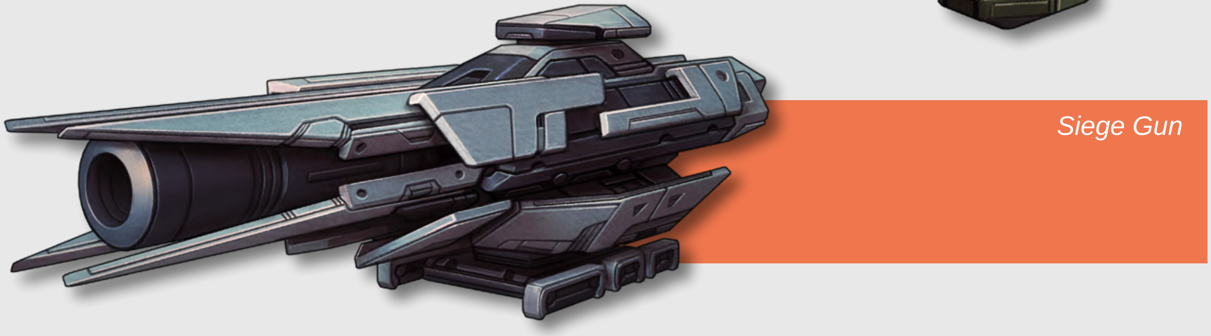

Heavy Mortar


Field Gun

	Magazine				
Traits	**Rounds**	**Cost**	**Rounds/Space**	**Crew**	**Loaders**
Artillery, Blast 6	1	Cr50	100	2	2
Artillery, Blast 15	1	Cr1000	0.5	50	30
Artillery, Blast 20	1	Cr1500	0.25	60	40
Artillery, Blast 25	1	Cr2500	0.1	80	60
AP 10, Artillery, Blast 10	1	Cr500	10	2	4
AP 5, Artillery, Blast 10	1	Cr200	25	2	3
AP 8, Artillery, Blast 12	1	Cr300	8	2	4
AP 8, Artillery, Blast 15	1	Cr400	4	2	5
Artillery, Blast 10	1	Cr150	25	2	3
Artillery, Blast 12	1	Cr200	10	2	4
Artillery, Blast 15	1	Cr300	5	2	5
Artillery, Blast 8	1	Cr500	12	1	2
Artillery, Blast 10	1	Cr750	7	1	2
Artillery, Blast 15	1	Cr1000	3	1	2
AP ∞, Blast 20, Radiation	—	—	—	4	—
AP ∞, Blast 40, Radiation	—	—	—	4	—
AP ∞, Blast 50, Radiation	—	—	—	6	—
Artillery, Blast 5	1	Cr50	1,500	2	1
Artillery, Blast 6	1	Cr75	500	2	2
Artillery, Blast 8	1	Cr100	200	2	2
AP 10, Artillery, Blast 50	1	Cr5000	0.05	100	120



Mass Driver



Siege Gun

DIRECT-FIRE WEAPONS

All the weapons described in this section require the Heavy Weapons (vehicle) skill to use effectively, whether mounted on vehicles or in emplacements. Direct-fire weapons shoot at targets within their line of sight. Those with the Scope trait can fire to their full range without penalty, assuming they can see the target. Direct fire weapons do not require nor take advantage of forward observers.

While a direct fire weapon can fire indirectly as artillery weapons at up to four times their maximum range, such fire is highly inaccurate (at an additional DM-2). Their crews are generally not trained in the Heavy Weapons (vehicle) skill, nor does the weapon's fire control system normally have solutions to indirect fire missions.

AUTOCANNON

Autocannons are rapid-fire belt-fed weapons, with shells ranging from 20–65 millimetres, capable of providing tactical support against infantry, light vehicles and aircraft. Autocannons are generally used to protect bunkers or mounted on light armoured vehicles, aircraft or maritime vessels. Autocannons can use the variant ammunition found in the Specialised Ammunition section.

BLACK POWDER CANNON

Control of the seas during the Age of Sail on Terra was maintained by ships-of-the-line and frigates armed with dozens of cannons. These cannons provided the firepower to destroy other ships, bombard fortresses and hunt down pirates, but are not accurate at range. The light, medium and heavy black powder cannons are similar to 6-, 18- and 24-pounder cannons. These cannons can use canister rounds but not the other variants listed in the Specialised Ammunition chapter. With a full crew, the light, medium or heavy versions of this weapon can fire once every 5, 10 or 20 combat rounds.

CANNON

A large calibre gun used to arm the heavy tanks and armoured vehicles of mid-Tech Level armies. Cannons may use variant ammunition found in the Specialised Ammunition section.

GAUSS CANNON

This weapon uses advanced electromagnetic ('gauss') propulsion to accelerate a metal dart to tremendous speed. The projectile is a lump of dense metal that damages the target using kinetic energy and the gauss cannon is capable of firing them rapidly. The gauss cannon can use the variant ammunition found in the Specialised Ammunition section.

HYPERVELOCITY CANNON

The hypervelocity cannon is a large-bore rail or gauss weapon typically mounted in emplacements or very large vehicles. Despite its range, it can be used against targets in low orbit if it can be elevated far enough. This extended range (up to 500 kilometres) is only useful in direct fire at airborne or orbital targets as it cannot 'lob' its projectiles like a howitzer. The hypervelocity cannon can use the variant ammunition found in the Specialised Ammunition section.

MACHINEGUN

Designed to be mounted upon a vehicle or tripod, the machinegun has proven effective against light vehicles and aircraft but is primarily intended to attack advancing infantry. The machinegun may use rifle variant ammunition found in the Specialised Ammunition section.

RAILGUN

Using electromagnetic propulsion, this powerful vehicle-mounted cannon flings a solid projectile in a flat trajectory that damages the target using kinetic energy. Time of flight to the target is less than for conventional guns, making compensation for movement easier. Railguns with a fire-control system may ignore up to DM-2 for targeting a vehicle moving at a different Speed Band. The barbette version of this weapon is equivalent to the spacecraft railgun barbette and is normally mounted in a large turret.

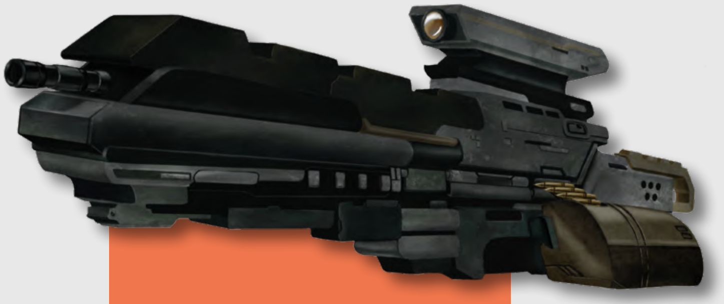
ROTARY AUTOCANNON

Although relatively small calibre, this autocannon uses rotating barrels, enabling it to sustain a hideous rate of fire. It is equally effective against infantry and light vehicles and, with armour-piercing ammunition, can even be effective against tanks. A rotary autocannon can use the variant ammunition found in the Specialised Ammunition section.

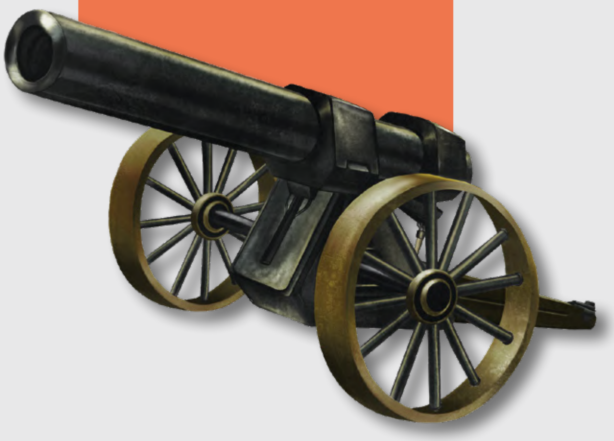
The very rapid-firing gauss gun is a support weapon that uses electromagnetic technology to deliver withering bursts of fire. Often used as an anti-personnel weapon on vehicles, consumption of ammunition is prodigious and large hoppers must be used to ensure adequate supply in combat. The VRF gauss gun can use the rifle variant ammunition found in the Specialised Ammunition section.

VRF MACHINEGUN

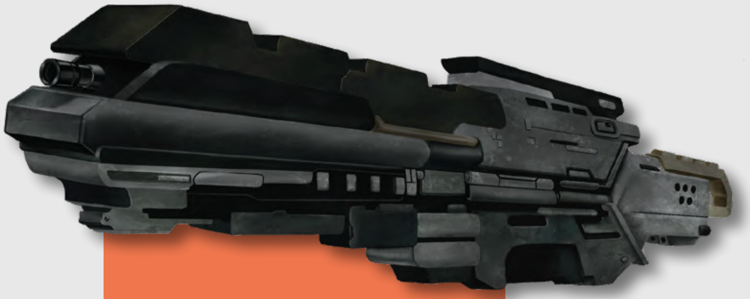
This weapon is constructed from six machinegun barrels that rotate through the firing position in order to maintain a very high rate of fire without adverse heating. The VRF machinegun can use the rifle variant ammunition found in the Specialised Ammunition section.



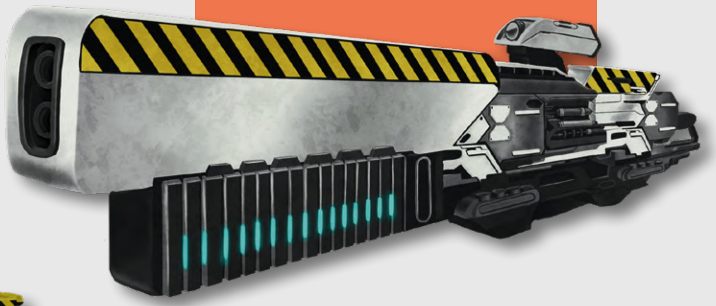
Autocannon (Light)



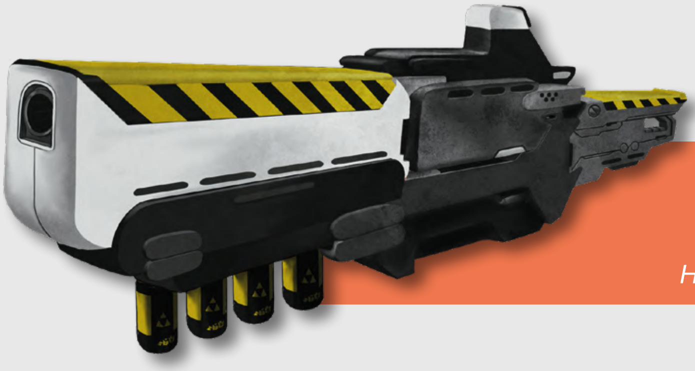
Black Powder Cannon



Cannon



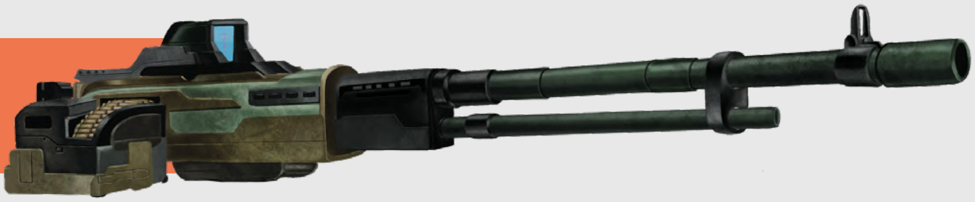
Gauss Cannon

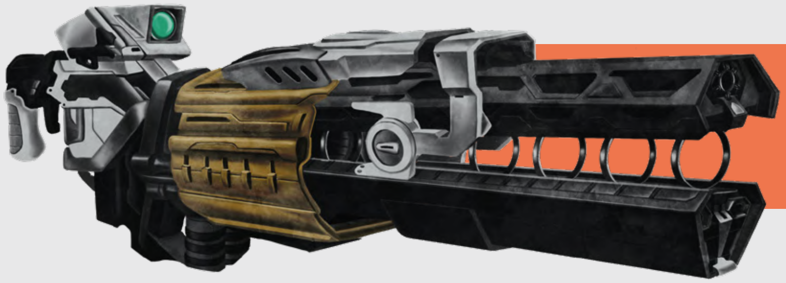


Hypervelocity Cannon

DIRECT FIRE PROJECTILE WEAPONS

Weapon	TL	Range (km)	Damage	Tons	Spaces	Cost	Power
Autocannon (light)	6	1	6D	0.25	1	Cr10000	P
Autocannon (medium)	6	1	8D	0.5	2	Cr25000	P
Autocannon (heavy)	7	1	1DD	1	4	Cr45000	P
Black Powder Cannon (light)	2	0.4	6D	1	4	Cr3000	—
Black Powder Cannon (medium)	2	0.8	8D	2	8	Cr10000	—
Black Powder Cannon (heavy)	2	1.6	1DD	3	12	Cr15000	—
Cannon (light)	5	1.5	6D	0.5	2	Cr100000	—
Cannon (medium)	6	2	1DD	1	4	Cr200000	—
Cannon (heavy)	7	3	2DD	2	8	Cr300000	—
Gauss Cannon (light)	12	1	6D	0.5	2	Cr60000	P
Gauss Cannon (medium)	12	2	1DD	1	4	Cr100000	P
Gauss Cannon (heavy)	12	3	2DD	2	8	Cr225000	P
Hypervelocity Cannon	13	500	5DD	20	80	MCr3	F6
Machinegun (light)	4	0.4	3D	0.014	1	Cr1200	—
Machinegun (medium)	5	0.6	4D	0.05	1	Cr3000	—
Machinegun (heavy)	5	1	5D	0.1	1	Cr4500	—
Railgun (light)	9	5	1DD	0.5	2	Cr500000	F
Railgun (medium)	10	10	2DD	1	4	MCr1	F2
Railgun (heavy)	10	20	3DD	2	8	MCr1.5	F3
Railgun (barbette)	10	100	9DD	20	80	MCr2	F5
Rotary Autocannon	7	1	6D	0.5	2	Cr30000	P
VRF Gauss Gun	12	0.75	4D	0.25	1	Cr20000	P
VRF Machinegun	7	0.5	4D	0.25	1	Cr12000	P


Heavy Machinegun


Railgun

	Magazine				
Traits	**Rounds**	**Cost**	**Rounds/Space**	**Crew**	**Loaders**
Auto 3	500	Cr1000	2,000	1	1
Auto 3	100	Cr1500	1,000	1	1
Auto 3	100	Cr2000	500	1	1
Inaccurate	1	Cr50	50	3	1
Inaccurate	1	Cr150	25	6	2
Inaccurate	1	Cr300	16	9	3
Blast 6	1	Cr200	200	1	1
Blast 10	1	Cr300	100	1	1
Blast 10	1	Cr500	50	1	1
AP 5, Auto 3	200	Cr800	20,000	1	1
AP 10, Auto 3	200	Cr1000	10,000	1	1
AP 15, Auto 2	60	Cr800	8,000	1	1
AP 50, Scope	50	Cr5000	500	1	1
Auto 3	100	Cr200	20,000	1	1
Auto 3	100	Cr200	20,000	1	1
Auto 3	100	Cr400	40,000	1	1
AP 30, Scope	50	Cr2500	5,000	1	1
AP 40, Scope	50	Cr5000	2,500	1	1
AP 45, Scope	50	Cr10000	1,250	1	1
AP 50, Scope	50	Cr10000	125	1	1
Auto 5	500	Cr1200	20,000	1	1
AP 5, Auto 8	400	Cr1000	80,000	1	1
Auto 6	1,000	Cr1250	40,000	1	1

VRF Gauss Gun

VRF Machinegun

ENERGY WEAPONS

Direct fire energy weapons include lasers and high-energy weapons such as plasma and fusion guns. All these weapons require a powered vehicle to operate and many, especially high-energy weapons and larger lasers, require a nuclear power plant.

AEROSPACE DEFENCE LASER

A powerful laser weapon designed for emplaced or mobile aerospace defence. It consumes immense power but delivers impressive damage. Primarily intended to engage missiles and small craft, it can attack starships, aircraft and grav vehicles equally well. This weapon requires a nuclear-powered vehicle.

FUSION CANNON

Relatively compact, the fusion cannon can burn through nearly any armour. A fusion gun requires a nuclear-powered vehicle.

FUSION GUN

One of the most powerful ground-based weapons ever made, the fusion gun can blast through just about any material. A fusion gun requires a nuclear-powered vehicle.

GATLING LASER GUN

A relatively low-powered, lower tech vehicle-mounted laser weapon, the gatling laser gun uses several cryogenically cooled barrels fired in succession to deliver a hail of fire. The gatling laser is often used as an air-defence weapon.

LASER CANNON

A single laser main gun for a vehicle, the laser cannon is the first truly effective vehicle energy weapon. It stores energy between shots in bulky capacitors.

LASER GUN

A large aperture beamed laser gun provides superior range and power to a laser weapons system but requires a nuclear-powered vehicle to operate.

LASER DRILL

This spacecraft-grade laser drill is intended for asteroid mining but can be used as a weapon. It is very accurate when laboriously calibrated and fired against a stationary target but unsuited to the rapid movement required for combat. Its high-intensity beam requires a nuclear-powered vehicle to operate.

When used as a mining or tunnelling tool, the laser drill can cut through up to 300 cubic metres of rock per hour but requires other machines or tools to clear debris and careful monitoring to avoid overheating. Its beam is intense enough to cut crystaliron at 20% of its capacity and superdense materials at 10%.

PLASMA CANNON

Sized to fit moderate-sized fighting vehicles, the plasma cannon soon completely supplants chemical-propelled cannon as a main battle armament and holds its own against lasers and gauss weapons. A plasma cannon is the only high-energy (plasma or fusion) weapon that can operate on a standard powered vehicle but has limited range.

PLASMA GUN

A heavy plasma gun designed for mounting on vehicles, this weapon is generally fitted to advanced grav vehicles and some aircraft. However, it is intended more as a support weapon than main anti-vehicle armament. A plasma gun requires a nuclear-powered vehicle.

PULSE LASER GUN

This laser gun fires pulses of coherent light to blast through its target. A pulse laser gun requires a nuclear-powered vehicle.

RAPID-FIRE FUSION GUNS

The newest classes of battle tank use a rapid-fire fusion gun instead of the standard fusion gun. Rapid-fire fusion weapons become available at TL14, are designated with the prefix ‘RF’ and preclude the need for an auxiliary automatic weapon. These weapons require a nuclear-powered vehicle.

RAPID-FIRE PLASMA GUNS

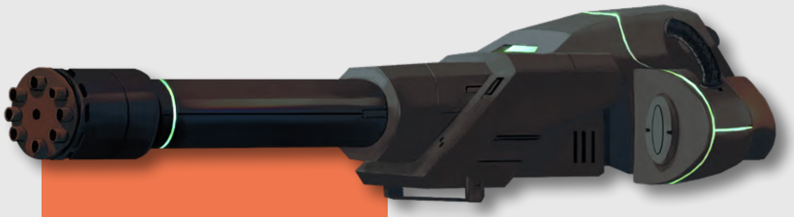
Less powerful than a rapid-fire fusion gun and without the radioactive effects, the rapid-fire plasma gun is an option often provided on export models and to budget-conscious or more civilised (or squeamish) militaries. They have a slightly lower range than standard plasma guns and a tendency to spread, giving them a larger blast area. These weapons require a nuclear-powered vehicle.

STUN CANNON

A stun cannon is a crowd-control weapon similar to hand-held stunners but able to affect a larger area. While very limited in range, it is useful as a nonlethal means of attacking unprotected crowds or rioters.

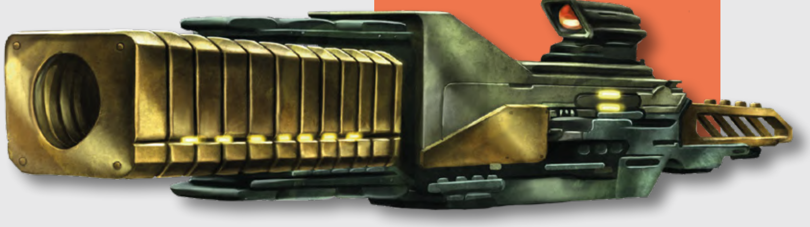
ENERGY WEAPONS

Weapon	TL	Range (km)	Damage	Tons	Spaces	Cost	Power	Traits
Aerospace Defence Laser	12	120	3DD	12	48	MCr4	F5	Accurate, AP 10
Fusion Cannon (light)	12	1	1DD	1	4	MCr1	F	AP 8, Blast 6, Radiation
Fusion Cannon (medium)	13	2	1DD	1.5	6	MCr1.4	F	AP 10, Blast 8, Radiation
Fusion Cannon (heavy)	14	3	2DD	2	8	MCr1.8	F2	AP 15, Blast 10, Radiation
Fusion Gun-X	13	2	3DD	1	4	MCr1.5	F8	AP 6, Blast 6, Radiation
Fusion Gun-Y	14	5	4DD	1	4	MCr2	F12	AP 8, Blast 8, Radiation
Fusion Gun-Z	15	10	5DD	1	4	MCr3	F15	AP 20, Blast 20, Radiation
Fusion Gun (barbette)	12	25	15DD	20	80	MCr4	F20	AP 30, Blast 30. Radiation
Gatling Laser	8	4	6D	2	8	Cr500000	P	Accurate, AP 5, Auto 4
Laser Cannon (light)	8	2	5D	0.25	1	Cr50000	P	AP 3
Laser Cannon (medium)	10	5	7D	0.5	2	Cr100000	P	AP 5
Laser Cannon (heavy)	11	10	1DD	1	4	Cr200000	P	AP 8
Laser Drill	8	1	2DD	1	4	Cr150000	F4	AP 40, Inaccurate
Laser Gun (light)	9	2	8D	0.5	2	Cr200000	F2	Accurate, AP 2
Laser Gun (medium)	10	5	1DD	1	4	Cr500000	F4	Accurate, AP 3
Laser Gun (heavy)	10	10	2DD	2	8	Cr750000	F6	Accurate, AP 4
Laser Gun (barbette)	10	25	5DD	20	80	MCr1	F8	Accurate, AP 5
Plasma Cannon (light)	10	1	1DD	1	4	Cr300000	P	AP 6, Blast 4



Gatling Laser Gun

Aerospace Defence Laser



ENERGY WEAPONS

Weapon	TL	Range (km)	Damage	Tons	Spaces	Cost	Power	Traits
Plasma Cannon (medium)	11	2	1DD	1.5	6	Cr400000	P	AP 10, Blast 5
Plasma Cannon (heavy)	12	3	2DD	2	8	Cr500000	P	AP 20, Blast 8
Plasma Gun-A	10	2	2DD	1	4	MCr1	F4	AP 4, Blast 8
Plasma Gun-B	11	5	3DD	1	4	MCr2.5	F6	AP 6, Blast 10
Plasma Gun-C	12	10	3DD	1	4	MCr3.5	F8	AP 8, Blast 20
Plasma Gun (barbette)	11	25	12DD	20	80	MCr5	F12	AP 20, Blast 30
Pulse Laser Gun (light)	9	5	1DD	0.5	2	Cr500000	F2	AP 3
Pulse Laser Gun (medium)	9	10	2DD	1	4	MCr1	F4	AP 4
Pulse Laser Gun (heavy)	9	20	3DD	2	8	MCr1.5	F6	AP 6
Pulse Laser Gun (barbette)	9	50	9DD	20	80	MCr2	F8	AP 8
Rapid Fire Fusion Gun-RFX	14	5	3DD	1	4	MCr3	F12	AP 10, Auto 2, Blast 5, Radiation
Rapid Fire Fusion Gun-RFY	15	5	3DD	1	4	MCr8	F15	AP 15, Auto 2, Blast 10, Radiation
Rapid Fire Fusion Gun-RFZ	16	5	3DD	1	4	MCr10	F20	AP 20, Auto 3, Blast 15, Radiation
Rapid Fire Plasma Gun-RFA	12	5	2DD	1	4	MCr2	F6	AP 5, Auto 3, Blast 15
Rapid Fire Plasma Gun-RFB	13	5	2DD	1	4	MCr3	F10	AP 10, Auto 3, Blast 20
Rapid Fire Plasma Gun-RFC	14	5	2DD	1	4	MCr34	F12	AP 15, Auto 4, Blast 30
Stun Cannon (light)	11	0.02	3D	0.25	1	Cr50000	P	Blast 10, Stun, Zero-G
Stun Cannon (medium)	12	0.04	4D	0.5	2	Cr200000	P	Blast 15, Stun, Zero-G
Stun Cannon (heavy)	12	0.06	4D	1	4	Cr500000	P	Blast 20, Stun, Zero-G

Laser Gun

Plasma Gun

ROCKETS, BOMBS & MISSILES

All the weapons described in this section require the Heavy Weapons (vehicle) skill to use effectively. Ranges are listed in kilometres.

ANTI-AIR MISSILE

A standard weapon carried in bays or hanging from the hardpoints of many aircraft, the anti-air missile sees widespread use until direct-energy weapons and advanced targeting systems arrive. The light anti-air missile is also found on ground vehicles to provide a cheap response to aerial threats. A longer-range version of the missile is designed to engage targets far beyond visual range and is often mounted on dedicated interceptors.

ANTI-TANK MISSILE

Small and compact, this missile nevertheless delivers a deadly punch. It is commonly seen on attack aircraft, although versions are sometimes mounted as external auxiliary weapons on the turrets of lighter armoured vehicles to give them some offensive capability against heavier enemies.

BOMB

Unguided high-explosive bombs are beautiful in their simplicity but devastating in effect. Accurately dropped onto a target, they blast apart anything short of a hardened fortification. Bombs can use the variant ammunition found in the Specialised Ammunition section. A guided bomb has a horizontal range equal to half the altitude of the launching aircraft.

BOMBARDMENT MISSILE

A large missile, this weapon is intended to rain death upon enemies at great distance. Typically fired in salvoes, it is perfect for attacking fortifications but has sufficient guidance systems to track moving vehicles. Bombardment missiles can use the variant ammunition found in the Specialised Ammunition section.

BOMBARDMENT ROCKET RACK

This weapon usually appears as a self-contained rack suitable for mounting on the back of a truck or similar vehicle. It contains 12 large rockets with high-explosive warheads that can be fired one at a time or rippled off in a rolling salvo. These rockets can use the variant ammunition found in the Specialised Ammunition section.

EARTHQUAKE BOMB

The earthquake bomb is the ultimate extent of taking a good idea to its logical conclusion – an air-launched bomb that is as large as the aircraft of its Tech Level can carry. Normally, these are specially modified aircraft, although some societies at war might build aircraft dedicated to the delivery of these weapons. The immense damage caused by this bomb is not from the primary effects of its explosives but rather the artificial earthquakes it generates after penetrating the ground and then exploding. Earthquake bombs can use the variant ammunition found in the Specialised Ammunition chapter. Like its smaller cousins, a guided earthquake bomb has a horizontal range equal to half the altitude of the launching aircraft.

PLASMA MISSILE RACK

A terrifying weapon to be on the receiving end of and capable of flattening entire cities when used en masse, the plasma missile rack ripple-fires medium-sized missiles to devastating effect. Its plasma warheads detonate with the power of a small sun, vaporising anything within their lethal zone. Once emptied, a rack must be reloaded, a process that requires one round per missile.

ROCKET POD

This is a pod that contains rockets with high-explosive warheads. The pod can be installed on most vehicles and aircraft, and is usually aimed by pointing the craft. Rockets can be fired one at a time or rippled off in a rolling salvo. Rocket pods can use the variant ammunition found in the Specialised Ammunition section. Once emptied, a pod must be reloaded, a process that requires one round per rocket.

TAC LAUNCHER

A support weapon capable of firing battlefield tactical missiles, this launcher provides a cheap and easy way to arm a vehicle with missiles and it can use a variety of different missile types. Reloading a tac launcher requires one round per missile.

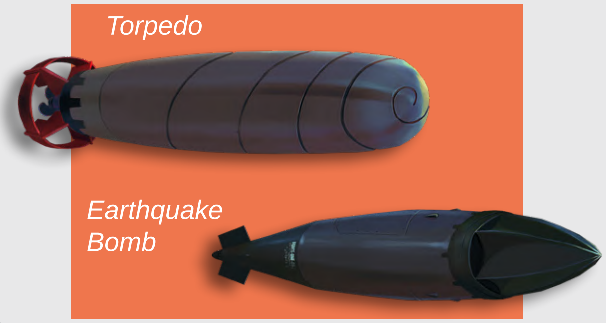
ROCKETS, BOMBS AND MISSILES

Weapon	TL	Range (km)	Damage	Tons	Spaces	Cost	Power
Anti-Air Missile (light)	7	10	6D	0.1	1	Cr5000	—
Anti-Air Missile (standard)	7	20	8D	0.15	1	Cr12000	—
Anti-Air Missile (long range)	7	100	8D	0.25	1	Cr22000	—
Anti-Tank Missile	7	6	8D	0.2	1	Cr18000	—
Bomb (light)	4	—	1DD	0.1	1	Cr1500	—
Bomb (medium)	4	—	2DD	0.5	2	Cr4000	—
Bomb (heavy)	4	—	3DD	1	4	Cr8000	—
Bombardment Missile	9	200	1DD	1	4	Cr36000	—
Bombardment Rocket Rack	6	8	5D	2	8	Cr30000	—
Earthquake Bomb	4	—	5DD	10	40	Cr100000	—
Plasma Missile Rack	12	50	4DD	2	8	MCr1	P
Rocket Pod (light)	6	1.5	4D	0.25	1	Cr8000	P
Rocket Pod (medium)	6	2	6D	0.5	2	Cr12000	P
Rocket Pod (heavy)	6	3	8D	1	4	Cr16000	P
Tac Launcher (anti-aircraft)	8	10	8D	0.25	1	Cr16000	P
Tac Launcher (anti-personnel)	8	6	4D	0.25	1	Cr12000	P
Tac Launcher (armour piercing)	8	6	8D	0.25	1	Cr15000	P
Torpedo (primitive)	4	1	1DD	0.5	2	Cr3000	—
Torpedo (basic)	5	5	3DD	0.5	2	Cr5000	—
Torpedo (advanced)	8	50	5DD	0.5	2	Cr12000	—
Water Cannon	5	0.1	—	0.5	2	Cr2000	P

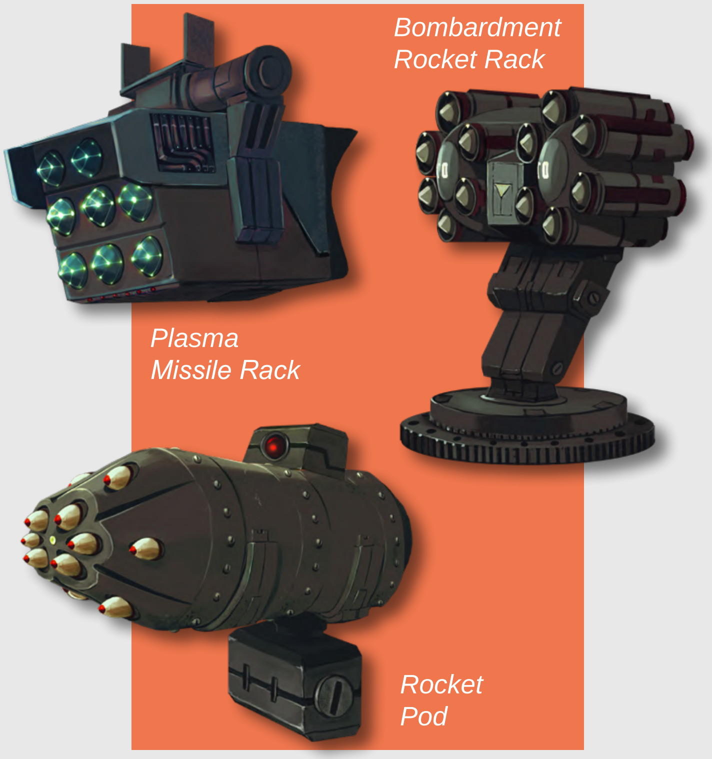
TORPEDO

Effectively an underwater missile, torpedoes are large and unwieldy weapons when they first appear but can prove extremely threatening to even the largest ships. Development of torpedoes accelerates rapidly, spelling the demise of larger ships until defences improve to match them. Torpedoes travel through the water at two Speed Bands faster than a standard watercraft of the same Tech Level (see page 118). At TL8 and above, a supercavitating torpedo is available at the Cost of 1 Space of supercavitating drive (see page 52). A supercavitating torpedo has the same Speed Band and range as a supercavitating submersible of the same Tech Level.

Anti-Air Missile
Bomb
Anti-Tank Missile
Bombardment Missile



Traits	Magazine Rounds	Magazine Cost	Rounds/Space	Crew	Loaders
One Use, Smart	—	—	—	—	—
One Use, Smart	—	—	—	—	—
One Use, Smart	—	—	—	—	—
AP 30, One Use, Smart	1	—	—	—	—
AP 20, Blast 20, One Use	1	—	—	—	—
AP 25, Blast 25, One Use	1	—	—	—	—
AP 30, Blast 30, One Use	1	—	—	—	—
AP 20, Blast 20, One Use	1	—	—	—	—
Auto 3, Blast 15	12	Cr8000	2	1	0
Blast 250, One Use	1	Cr100000	—	—	—
AP 20, Auto 3, Blast 15, Smart	12	Cr400000	2	1	0
Auto 3, Blast 5	18	Cr9000	24	1	0
Auto 3, Blast 10	9	Cr8000	6	1	0
AP 5, Auto 3, Blast 10	6	Cr12000	2	1	0
Scope, Smart	4	Cr8000	6	1	0
Blast 10, Scope, Smart	4	Cr4000	6	1	0
AP 10, Scope, Smart	4	Cr6000	6	1	0
AP 10, One Use, Smart	1	—	—	—	—
AP 30, One Use, Smart	1	—	—	—	—
AP 50, One Use, Smart	1	—	—	—	—
—	10	—	10	1	0

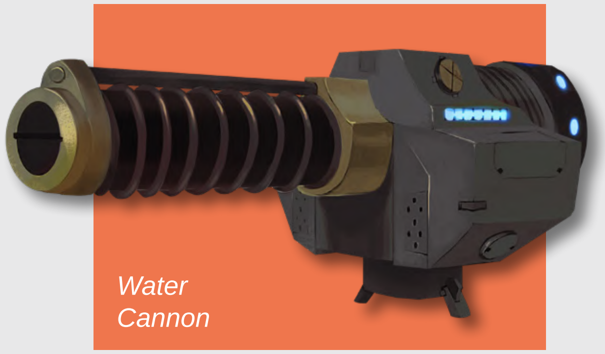

Bombardment Rocket Rack

Plasma Missile Rack

Rocket Pod

WATER CANNON

These ‘weapons’ are used for fire suppression, riot control and dispersal of chemicals. Any target struck by a water cannon must pass a Difficult (10+) STR check or be knocked prone and rendered helpless for a round. A water cannon’s magazine is dependent upon how much water it has access to. By default, it can fire for 10 rounds. Every extra Space dedicated to the water cannon increases its magazine size by 10. A water cannon aboard watercraft can fire until its fuel runs out or its cannon jams from unfiltered seawater.


Water Cannon

SPECIALISED AMMUNITION

The weapons specialist knows that a bullet is never just a bullet. One advantage slug throwers have over energy weapons is that their ammunition can be customised, often heavily, to achieve specific desired outcomes (which normally result in a dead enemy). As the size of the shell increases, generally so do the number of options available, with large artillery pieces being capable of firing an amazing array of warheads. Some ammunition types are described as not being available for certain weapon types and none of these options are available for energy weapon use.

The rules and options provided here should be treated as a toolkit that can be modified to suit a specific universe, world, or even individual arms manufacturer. As always, the Referee is the final arbiter of what is possible and can rule that certain types of ammunition are not available for certain guns.

To use a particular modification, the weapon firing it must be manufactured at a Tech Level at least as high as that of the ammunition. The Special Ammunition table lists the effects and traits of each. Unless specifically indicated, a single round of ammunition can only have one modification.

Modifiers to the ammunition's damage, Cost, Range or other characteristics are noted. A blank line in the table means there is no change from the weapon's normal operation. If a non-Destructive weapon has its Damage score increased to 10D or higher, it becomes a Destructive weapon with Damage 1DD. It cannot be increased beyond this.

AEROSOL

Aerosol rounds disperse a fine mist that diffuses lasers fired into or through it, but the mist does not block normal vision. Any laser attack tracing a line of sight into or through the mist has its damage reduced by -10. Laser communications are completely blocked. Multiple uses will not increase this effect; it will only reset the time interval for dissipation.

ARMOUR PIERCING

These rounds are pointed projectiles of dense or very hard material designed to punch through armour. They provide a weapon with an AP trait equal to the number of damage dice it rolls. If the weapon already has the AP trait, this is added to the final AP score.

Armour Piercing Discarding Sabot (APDS)

Representing several variations on the theme of a rod penetrator launched with a sabot and featuring increasingly long acronyms, APDS is an anti-armour round representative of various efforts to get through armour. APDS ammunition provides a weapon with an AP trait equal to triple the number of damage dice it rolls but reduces damage by one point per damage dice. If the weapon already has the AP trait, this is added to the final AP score. Artillery weapons and bombs cannot use APDS rounds.

BATON

A baton round is considered non-lethal, usually filled with rubber, plastic or some less solid material. It is far from harmless but delivers less lethal results, with half (round up) of any damage applied as Stun damage. Any AP or Blast trait associated with the weapon is negated by use of a baton round.

BOMBLET

These rounds are warheads that break apart above the target to scatter small bomblets over a wide area. Only artillery weapons and bombs can use bomblet rounds, and any AP trait is lost.

CANISTER

Also called beehive, grapeshot and flechette, canister rounds are used for close-range defence against enemy infantry and effectively turn the weapon into a giant shotgun. Artillery weapons and bombs cannot use canister rounds.

CHEMICAL

This round creates a cloud of gas which, depending on composition, is either incapacitating or deadly. Any living target within the cloud that does not have a respirator or sealed suit is attacked as if by a poison with a Very Difficult (12+) END check, Damage 1D, and Interval of one round. A non-lethal round does Stun damage, while a lethal round causes injury and often death from lung or skin contact. Gas clouds dissipate after 1Dx3 rounds, although heavy winds and rain can drastically reduce this.

CONCUSSION

Often used in training exercises and as a distraction in close assaults, concussion rounds are non-lethal shells that burst with a loud noise and bright flash. They are intended to stun opponents rather than kill them.

DIRECTED PLASMA

Directed plasma rounds are an advanced version of shaped charge weapons, intended to destroy hard targets. Directed plasma rounds for pistols and rifles become available at TL16.

ELECTROMAGNETIC PULSE

This round unleashes a massive burst of electromagnetic radiation that does not harm living tissue but causes unshielded electronics to shut down for 1D minutes. Unshielded electronics of more than two Tech Levels lower than that of the round are permanently fried, while all electronics of more than two Tech Levels higher are immune.

EXTENDED RANGE

Extended range rounds use more efficient propellant or even a rocket boost to increase their velocity and therefore effective range. Artillery weapons can combine extended range ammunition with other types simply by adding their cost multipliers together.

FLARE

This is an illuminating round designed to shed light over a wide area. The round is fired into the air and then descends on a parachute (and can only be used on worlds of Atmosphere 2+). Everything within the Blast area is illuminated as normal daylight. Thermal and light-intensification equipment is designed to cut out to protect the wearer's sight, so these rounds cannot be used to blind the enemy, although they will make advanced sighting gear less useful and thus level the playing field for those without it. The illumination will last for 1D + the world's Atmosphere rounds.

FRAGMENTATION

This is an anti-personnel warhead, throwing out shards of shrapnel across a very wide area. If the weapon does not have a Blast trait, fragmentation rounds will give it Blast 10.

FOAM

A foam round, fired from grenade launchers or heavier weapons, disperses a sticky foam that temporarily incapacitates a target. If the amount of damage inflicted by the foam round exceeds a person's STR or a vehicle's Hull, ignoring all armour, the target is stuck to the ground or a nearby wall. Escape requires a Very Difficult (12+) STR check, which can be attempted once per round. A vehicle can unstick itself with a Difficult (10+) skill check, with a negative DM equal to the foam 'damage' divided by the vehicle's Hull, rounding up in the foam's favour. Foam rounds for shotguns become available at TL11 and are ineffective against vehicles with Hull 5+.

FUEL-AIR

A fuel-air round dispenses a cloud of highly flammable droplets that are ignited as they mix with air (this round only functions on worlds that have an oxygen component to their atmosphere). The resulting airborne explosion has been compared to a nuclear detonation. If the weapon does not have a Blast trait, fuel-air rounds give it Blast 10.

GUIDED

Some warheads can be either guided by the operator or fitted with a self-homing capability. Guided rounds become available for shotguns at TL8 and rifles and pistols at TL10. The guided modification can be combined with others simply by adding their cost multipliers together.

HIGH EXPLOSIVE ARMOUR PIERCING (HEAP)

High-explosive armour-piercing rounds use shaped charge warheads or similar technologies to penetrate thick levels of armour before detonating inside the target. HEAP ammunition provides a weapon with an AP trait equal to double the number of damage dice it rolls, before the bonus dice is added for HEAP ammunition. Destructive weapons multiply this by 10; for instance, a 2DD weapon with HEAP ammunition would do 3DD damage and have the AP 40 trait.

SPECIAL AMMUNITION

Weapon	TL	Range	Damage	Cost	Traits
Aerosol	7	—	—	x3	Blast 12
APDS*	5	+10%	-1 per dice	x5	AP X
Armour Piercing*	4	—	—	x4	AP X
Baton*	5	-25%	½ Stun	x2	Stun (50%)
Bomblet	7	—	3D	x4	Blast 20
Canister	2	20	4D	x2	Blast 20
Chemical	5	—	Special	x5	Blast 12
Concussion	7	—	4D	x1	Stun
Directed Plasma	15	—	+1D	x10	AP x3, Blast 0
Electromagnetic Pulse	9	—	None	x10	Blast 20
Extended Range*	7	+25%	-1D	x3	—
Flare	4	—	None	x1	Blast 100
Fragmentation	6	—	4D	x1	Blast x2
Foam	9	—	Special	x5	—
Fuel-air	7	—	1DD	x8	Blast x3
Guided†	7	—	—	x6	Smart
HEAP	5	-25%	+1D	x8	AP Special
Incendiary*	8	—	—	x3	Blast X, Fire
Net	8	-50%	Special	x3	Blast x0.5
Neurotoxin	5	—	Special	x10	Blast 12
Nuclear	6	—	6DD	x20	Blast 500, Radiation
Plasma	15	—	+1D	x10	AP x2, Blast x2
Smoke	4	—	None	x1	Blast 12
Solid Shot*	5	-25%	—	x2	AP X
Thermal Smoke	7	—	—	x2	Blast 12
Tracer	5*	—	—	x2	Accurate (see text)

* Useable by rifles and heavy weapons.

† Useable by rifles as well at TL10. Guided bombs have a horizontal range equal to half the altitude of the launching aircraft.

INCENDIARY

Incendiary warheads are designed to set fire to things, causing flammable material nearby to catch fire. The round's Blast trait is equal to the number of damage dice of the weapon.

NET

This deploys a weighted net at a target. Range is reduced by 50%, and a target hit by a net does not sustain any damage but is immobilised. The target can escape from the net by making a successful Average (8+) DEX check (1D rounds). If multiple targets are caught in a net, each must make a separate check to escape with DM+1 for every other target that has already escaped. If assisted by someone not trapped, the target can add DM+2 to the escape attempt.

NEUROTOXIN

This round creates a cloud of gas that, if inhaled, likely proves deadly. Any living target within the cloud that does not have a respirator or sealed suit is attacked

as if by a poison with a Very Difficult (12+) END check, Damage 1D INT and an Interval of one round. Gas clouds dissipate after 1Dx3 rounds, although heavy winds and rain can drastically reduce this time.

NUCLEAR
Highly illegal on nearly every world, these warheads create a small nuclear explosion wherever they land, laying waste to everything nearby. Nuclear rounds are only available for grenade launchers or other heavy weapons of 40mm or larger calibre at TL13 and above.

PLASMA
Plasma warheads are an advanced form of high explosive, designed to eliminate both soft and armoured targets, depending on what weapon they are fired from. Plasma rounds for pistols and rifles become available at TL16. If a weapon does not have a Blast trait, plasma rounds give it Blast 3.

SMOKE
Smoke rounds create a thick cloud that disrupts vision. This imposes DM-2 to all attacks on targets within the cloud. IR vision completely bypasses the cloud of smoke. Smoke clouds dissipate after 1Dx3 rounds, although heavy winds and rain can drastically reduce this time.

SOLID SHOT
A basic anti-armour round, solid shot is essentially a pointed projectile of dense or hard material. Solid shot provides a weapon with an AP trait equal to half the number of damage dice it rolls, rounding up. If the weapon already has the AP trait, this is added to the final AP score.

THERMAL SMOKE
This acts as a smoke round but throws out hot particles that block IR vision as well. This imposes DM-2 to all attacks on targets within the cloud. Smoke clouds dissipate after 1Dx3 rounds, although heavy winds and rain can drastically reduce this time.

TRACER
Tracers are rounds that produce a visible trail of light when fired, allowing aim to be adjusted to grant a weapon the Accurate trait. Tracer rounds are normally integrated in a magazine or belt of ammunition at a fraction equal to an Auto trait, allowing at least one tracer bullet to fire per burst. If all rounds are tracers, the cost is multiplied further by three. Tracers only provide the Accurate trait when fired in burst or fully automatic mode. Tracers decrease the effectiveness of stealth and concealment, granting attempts to detect the firer DM+2.

ARCHAIC WEAPONS

Prior to the development of gunpowder, weapons of war were mostly carried by soldiers or animals but some weapons, such as ballistae and catapults, were available for armies and navies to use. Ranges are listed in kilometres but even direct fire weapons lack the Scope trait, making them inaccurate under even the best conditions. These weapons are often mounted on larger watercraft, providing additional firepower beyond bows and javelins during the closing phases of archaic naval combat. There are many variations of archaic heavy weapons and many names and overlapping definitions. For simplicity, this section considers the ballista to be a representative direct fire weapon and the onager and trebuchet as representatives of catapults.

Besides ballista darts, stone ammunition is the listed form of projectile for these weapons but equivalent mass objects, including incendiaries, explosives and even biological weapons could be substituted, although higher Tech Level special ammunition types cannot be used. Treat most archaic special ammunition as having a Blast trait equal to the damage dice of the stone projectile but damage is reduced to D3 instead of 1D.

BALLISTA

At lower Tech Levels, this is effectively a giant crossbow, using either tension or torsion to loose heavy bolts the size of spears at enemy infantry, cavalry, fortifications or ships. Its accuracy against smaller targets is questionable.

FIRE PROJECTOR

A primitive flamethrower able to project incendiary liquid short distances. A fire projector is a potentially powerful short-range weapon usable against enemy ships, troops and siege towers. A smaller version can be fired by one person as a primitive flamethrower, although only capable of Melee range. Reloading a fire projector requires its entire crew with the most qualified making an Average (8+) Heavy Weapons check (2D Minutes, DEX). Exceptional failure results in a spill of the flammable substance. Critical Hits that affect the weapon also result in a fuel spill.

ONAGER

A catapult using a twisted rope or torsion mechanism to loose a projectile from a bowl-shaped bucket. This weapon requires a significant reset after each shot, as the force of the catapult causes the base to shift.

ARCHAIC WEAPONS

Weapon	TL	Range (km)	Damage	Tons	Spaces	Cost	Power
Ballista (bolt)	1	0.2	4D	0.5	2	Cr2000	—
Ballista (25kg stone)	1	0.2	5D	0.5	2	Cr2000	—
Fire Projector	1	0.015	4D	1	4	Cr20000	—
Fire Flamethrower	1	Melee	3D	0.01	1	Cr5000	—
Onager (50kg stone)	1	0.4	6D	1	4	Cr5000	—
Ram (land-based)	1	Melee	Special	—	—	—	—
Ram (metal tipped)	1	Melee	Special	—	—	—	—
Trebuchet (100kg stone)	1	0.4	8D	4	16	Cr20000	—
Trebuchet (25kg stone)	1	0.8	4D	4	16	Cr20000	—

RAM

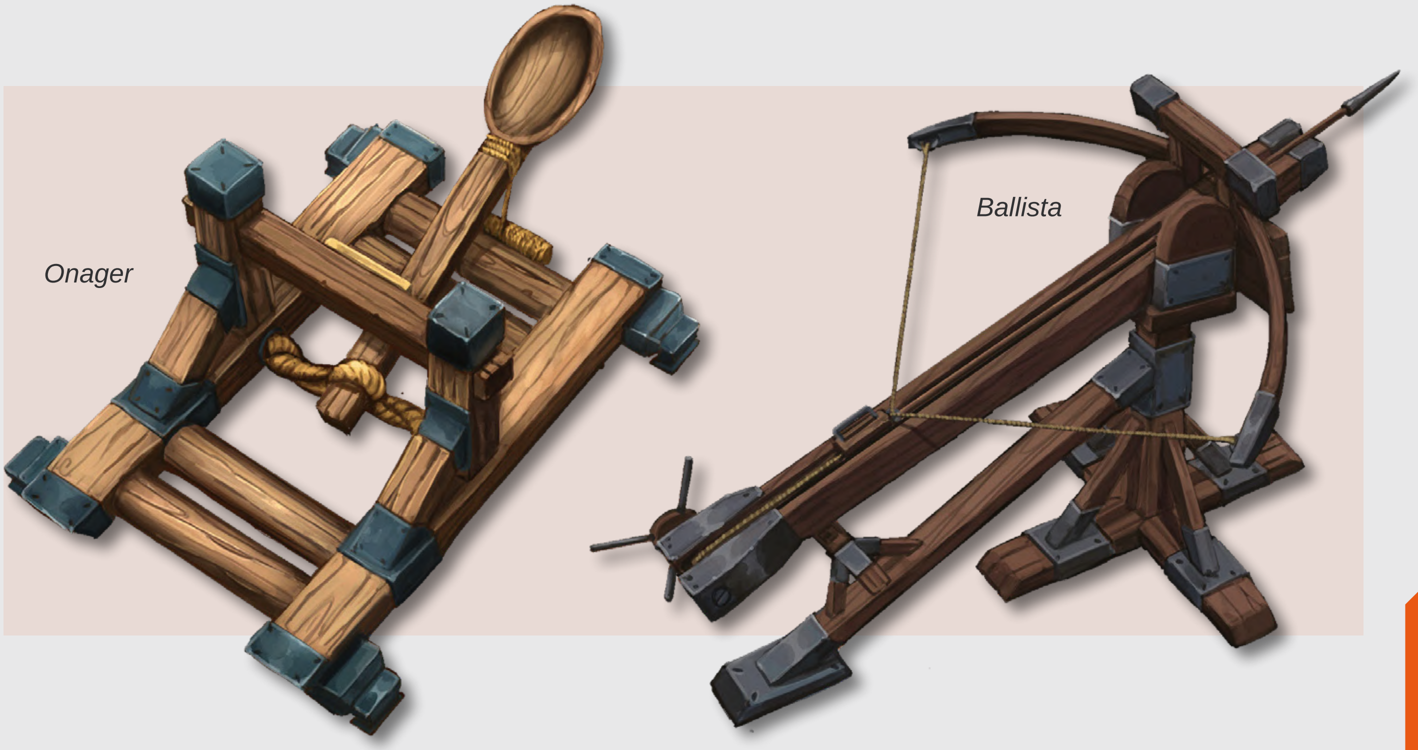
The ram covers a variety of weapons designed to smash things. A ram can be mounted on a vehicle to collide with, splinter or sink other vehicles; these are detailed on page 71. A ram can also be installed on a siege tower and used to attack a fortress or even carried by a large number of people and smashed into walls or doors.

Land-based rams are Melee-range devices. If carried, each Space of ram requires two people to carry it when in combat use or a fifth as many if installed in a siege tower. A ram causes 1D damage per Space, with rams at 10 Spaces in size causing 1DD, those at 20 Spaces in size causing 2DD, to a maximum of a 40 Space ram causing 4DD damage. A ram costs Cr100 per Space. A pointed metal ram head costs Cr100 per Space of the ram and adds AP 1 and one additional AP for every DD of damage.

> *For example, a metal-headed 30-Space ram requires a crew of 60 if carried or 12 in a siege tower. It has a Cost of Cr6000 and does 3DD damage with the AP 4 trait.*

TREBUCHET

A large catapult, often using a heavy counterweight, the trebuchet can hurl a large projectile. If loosing a smaller 25 kilogram shot instead, a trebuchet's range is doubled but its damage is halved.



	Magazine				
Traits	Rounds	Cost	Rounds/ Space	Crew	Loaders
AP 5, Inaccurate	1	Cr25	100	3	1
Artillery	1	Cr10	100	3	1
Blast 3, Fire	20	Cr500	100	4	0
Fire	10	Cr200	200	1	0
Artillery	1	Cr50	50	6	2
(see text)	—	—	—	—	—
(see text)	—	—	—	—	—
Artillery	1	Cr100	25	12	4
Artillery	1	Cr10	100	12	1

SPACECRAFT-SCALE WEAPONS

Spacecraft weapons from the *Traveller Core Rulebook* and *High Guard* can be mounted on vehicles. Many turret and barbette-sized weapons have been included in the Direct Fire and Energy Weapons sections but any spacecraft weapon can, in theory, be mounted upon a vehicle. To do this, a vehicle needs two things – enough Spaces to physically fit the weapon and sufficient power to operate it.

To place a spacecraft weapon into a vehicle, multiply the tonnage of the weapon by four. This is how many Spaces it will consume, to a minimum of one Space. Unless it is to be placed in a fixed mount, it will also need a spacecraft-style turret that consumes four Spaces. If mounted internally in a fixed mount, a turret-sized weapon consumes four Spaces. A barbette weapon consumes 20 Spaces inside the vehicle for its turret-like mounting and 5,000 kilograms or five tons for determining the mass of weapons a vehicle can mount. A bay consumes four times the listed tonnage, or 200, 400 or 2,000 Spaces.

Any weapon that needs spacecraft power to operate it requires a nuclear power plant to function. A spacecraft turret itself, although it requires power, can function with a regular vehicle power plant. A vehicle with a nuclear power plant has a Power output associated with it and a weapon that requires nuclear power has a similar requirement associated with it. If the weapon only requires Power 1, it is assumed to have enough power to operate it but spacecraft-scale weapons can draw an enormous amount of power and this should be compared to the Power output of the nuclear power plant. If firing weapons requires more than 25% of the power available to the vehicle, it might need to slow one Speed Band and if it requires more than 50% of available power, it must stop to fire.

To fire beyond 10 kilometres range, a spacecraft weapon requires installation of spacecraft sensors of at least Civilian Grade or vehicle sensors that have a range of equal to or more than the target's distance, although missiles and torpedoes can seek out targets using their own sensors, up to their normal spacecraft ranges, regardless of sensors on the vehicle.

When considering ammunition storage, a Space can hold three missiles or five sand canisters, while four Spaces can hold three torpedoes.

CENTRAL SUPPLY CATALOGUE

Many of the heavy weapons listed in this book are compatible with those in the *Central Supply Catalogue*, however some have been resized to better balance them with spacecraft-scale weapons. Where they differ, those in this book should supersede them. Smaller weapons, such as personal energy and slug weapons, can be installed in a vehicle. The Space allocation for each weapons mount can contain up to 250 kilograms of weapons per Space, with a minimum of one Space consumed.

MODIFICATIONS

Travellers might be satisfied with finding the right model or designing a brand-new vehicle and either buying it off the lot, ordering it from a manufacturer, or creating it on their own, whether in a machine shop or large fabricator. In other instances, the Travellers might already have a vehicle, maybe in new condition, perhaps gently or not-so-gently used, and may want to improve upon its capabilities in some manner, adding speed, luxury or some entirely unanticipated capability to an existing frame.

The simplest method to gain back usable Spaces for modifications is to remove existing cargo or passenger capacity. This is essentially a free process, as far as parts go.

LABOUR

Modifications require time. A skilled mechanic can perform alterations affecting one Space every hour, or for those not requiring Space changes, one hour per 10 Spaces of vehicle size. Removing and adding components to the same Space requires two separate operations. Travellers can do this themselves or hire a skilled mechanic. Special systems might require Electronics or other skills to replace and configure. Costs can vary widely depending on the availability of mechanics but can run as high as Cr100 per hour per skill level. If simple work is performed by a large pool of labourers, it can be as little as Cr10 per hour per skill level. The more complex and 'unique' the modification, the more likely labour costs will be high and skilled labour difficult to find.

Working area limitations are also a factor if using multiple labourers on large projects. Only one person can work on a Space at a time and a separate worker can be assigned for every two Spaces being worked on.

At the end of the work or after eight hours, whichever comes first, the Mechanic should make a Routine (6+) Mechanic check (INT or EDU) and, if successful, the work is complete. Failure usually requires another equal interval of time to complete the work, although an exceptional failure might result in damage to the vehicle or the new part.

COMPATIBILITY

Sourcing a part with a different Tech Level than that of the vehicle can be a challenge and finding it might be subject to availability restrictions such as those listed on page 4 of the *Central Supply Catalogue, or* might even serve as the outcome of a short adventure. The following assumes the part is readily available as an imported item.

When adding or changing components, the Tech Level of the replacement part should be within one Tech Level of the vehicle's manufacture. If it deviates further, it can only be installed on a successful Average (8+) Mechanic (or other applicable skill) check (1D hours, INT or EDU) with a negative DM equal to the difference in Tech Levels.

This check determines if the mechanic can rig up an interface to deal with the higher- or lower-tech part. If successful, the part still requires an additional 20% Cost surcharge per Tech Level if it deviates from the vehicle's Tech Level. Subsequent checks to successfully install the component also suffer a DM equal to the difference in Tech Levels.

In many cases, a piece of technology perfected at a lower Tech Level but still used at a higher Tech Level, would not be subject to this compatibility check. For example, short term life support is a TL6 item but is still in use at TL15 and above, and for a world and vehicle of TL15, the TL15 equivalent would be installed, not one nine Tech Levels more primitive. However, the compatibility check is always required when installing a more advanced part in a less advanced vehicle.

> *For example, to install a TL10 part in a TL8 vehicle, the mechanic must first make an Average (8+) check with DM-2 then, if successful, the part can be installed at 40% more than its listed Cost. This is additive with the normal changing option cost of 110% (see page 128), so the Cost would be 150% of the standard price. Failure indicates this particular part does not work or fit within the vehicle. Success indicates the Traveller has figured out how to make it work. Installation of the part requires the mechanic to perform a Routine (6+) check with DM-2.*

Items from different civilisations require a compatibility check and receive a negative DM, ranging from DM-1 for differences between Imperial and Zhodani technology (Imperial and Solomani technology is compatible, so it forgoes this check – this also applies to most client states and neutral human states in the vicinity of these polities), to DM-4 for Droyne technology with any other sophont's equipment. Costs also increase at a rate of 20% per DM imposed on these checks.

CHANGING FEATURES

Features can mostly be removed at will but some are integral to the frame of the vehicle. For example, AFV cannot be removed. Removal of a prerequisite feature causes dependent features to be lost, like removing jet engines would remove either supersonic or hypersonic features if present. Common sense must be applied when considering what else can be removed and removal might render the vehicle unable to operate. For example, removing the aerodyne feature from a rotorcraft does not create a helicopter, it creates a rotorcraft-looking vehicle that cannot fly. All feature removals cost as much as they would to add to a vehicle type. No more than 10% of the value of the feature can be recovered by selling parts. Removing a locomotive feature will free up 80% of the Spaces it originally required.

Most Travellers will not want to delete features but add them. The simplest rule is that a feature can only be added if it is available to the vehicle type. Neither can a feature be added if it is incompatible with another – unless the incompatible feature was removed first.

Adding a feature costs Cr100 per Space of the vehicle, plus at least 110% the Cost of the feature if it had been added during construction. Also, each additional feature consumes 5% of the vehicle's Spaces or at least one Space. Streamlining costs 125% of the original Cost and consumes 10% or at least two Spaces. The locomotive feature requires 60% instead of the regular 50% of the vehicle's Spaces to install and costs 150% of the initial feature Cost.

CHANGING CUSTOMISATIONS

Adding or removing a secondary power source, or a secondary or tertiary form of locomotion, is easier than adding or removing a feature. If the vehicle has the available Space for it, a secondary power source or additional locomotion modes can be added for 110% of the Cost at manufacture and consumes the same Spaces as an inherent customisation. Removal of any of these components gains back the Spaces consumed, costs Cr100 per Space to accomplish and can recover 25% of the Cost to install the equipment if it is in good working order.

Changing customisations for altering Speed or Range follows the same processes as detailed in the Customisation section, with an added cost of 10% or Cr100 per Space for any changes that have no listed Cost, such as fuel capacity. Only 10% of any value of removed components can be recovered.

Adding secondary or tertiary rocket locomotion is a popular modification but its legality might be a problem in some jurisdictions.

ADAPTING TO A NEW WORLD

Vehicles are generally designed to operate on their world of origin. In many cases, changes to Size and Atmosphere of a world has little effect but as noted in Airborne Movement on page 20, aeroplanes are especially susceptible to changes in gravity and atmospheric density. Making changes to aerodynamic surfaces and modifying or replacing engines can counteract some of these effects but a modified vehicle will never be as cost-efficient or agile.

Modifications to adapt a vehicle must be applied to the total of the vehicle's base Cost, the Cost of any features or modifications and any armour or hull modifications, since all these are subject to the effects of changes to its shape and control surfaces.

Each negative DM to the operator's skill can be removed at a Cost of 20% of the total above-listed items. At most, three DMs can be removed in this manner and the vehicle cannot be 'doubly modified' to, for instance, allow an aeroplane designed for a Dense atmosphere to fly in a Thin atmosphere.

Agility reductions cannot be corrected by this process but may be altered by changing features or controls to compensate.

Speed Band and Range reductions can be modified as part of the Cost but any Range gained by operating in an environment different from the world of origin are automatically lost during modification.

> *For example, the aeroplane described in the Airborne Movement section as moving from Terra (Size 8, Atmosphere 6) to Melchoir (Size 5, Atmosphere 5) arrives with a DM-4 to skill checks, Agility -1, no change to Speed Band and*

a Range of 75% its Terran Range. By spending 3 × 20% or 60% the Cost of its base Spaces and any features, modifications, armour and hull modifications, the operating DM can be reduced to -1 and its Range can be restored but it would still have Agility -1.

ARMOUR

Adding armour to a vehicle is difficult. The easiest method is to apply armour to the outer surface. If the total Spaces of armour (before and after adding it) consumed is less than or equal to 1% of the vehicle's Spaces, then the addition of the armour can be done by adding the Cost of the added armour, plus 10%. Any larger addition of armour to the vehicle's surface will increase its Space size. This might cause it to change some properties based on size (but will not grant a watercraft a Range bonus) and will always cause a reduction of Agility of -1, possibly in addition to any changes caused by increasing size. Removing armour consuming at least 1% of the vehicle's Spaces will potentially change characteristics to those of a smaller vehicle.

Adding or removing armour to a vehicle with a surface protection will negate its capabilities except in the case of pressurised hull, vacuum and hostile environment protections. This will affect any vehicle facing that received an armour increase and Costs for the lost capability are not recoverable.

Adding armour to the inside of a vehicle always consumes at least one Space and costs an extra Cr1000 per vehicle Space and one hour of labour per vehicle Space to remove and relocate the vehicle's internal components. It does, however, preserve any hull surface protection.

OPTIONS

Options are the easiest components to add or change. Those requiring no Spaces and not applied to the entire vehicle require 110% of their initial Cost to install and an hour of work. For items with a specific Space requirement, an hour per Space and 110% of the item cost is sufficient. Those that affect the entire vehicle require an hour per vehicle Space.

Removal of a component is the same amount of work as installation. Removed components can be resold for 1D×10% of their value but if the remover failed their Mechanic check, the component is no longer in working order and has no resale value.

AUTOMATION

Computers can be added just like any other Option, as can drone interfaces and vehicle robot brains, but the actuators required to control the vehicle require twice the Cost as an initial installation and take one hour's labour per vehicle Space to add.

WEAPONS

Weapons, mounts and fire control are treated as options for installation purposes. The larger complication with weapon installation is usually legal and bureaucratic.

STRIPPED FOR PARTS

A damaged, abandoned or junked vehicle might be useful for recovering parts. If the vehicle has been rendered inert by damage, it might have salvageable components. Anything that has not suffered a Critical Hit can be salvaged. If the total damage inflicted on a vehicle is twice its Structure, it is completely destroyed and only valuable as scrap material.

Even in perfect condition, a used vehicle's price is normally 1D×10% less than its original Cost. In some instances, it might be worth that much if first stripped of usable parts with the rest of its hulk recycled but that requires labour and the effort to sell the pieces.

In some situations, a single part might be worth more than the rest of the vehicle, especially if the part is original equipment on a rare or discontinued model. This should never be a random occurrence but could be part of an adventure for Travellers to locate, for instance, an original laser transceiver from an LSP Hopper '88 air/raft for a patron or their own collection.

FINE-TUNING

Vehicles are designed to operate at safe levels and follow approved regulations covering everything from traffic control to vehicle emissions to safety systems. These regulations might not be relevant on the world where the Travellers use the vehicle, or they may choose to flout regulations. While some of the regulations are just bureaucratic, others are based on common sense.

MORE SPEED!

A modification can increase the maximum Speed Band of a vehicle by no more than one step. Vehicles that cannot exceed the speed of sound because of feature limitations cannot travel faster than Subsonic.

This modification can be used with or without the normal Speed customisations. It does not consume Spaces but costs three times the base Cost of vehicle's Spaces, reduces Range at its new maximum Speed by 50% and Agility by -1. It does not increase Cruise Speed but does decrease Cruise Range based on the new maximum Range.

For every hour of operation at its new maximum Speed Band, roll 2D. On an 11+ the vehicle suffers a Critical Hit of Severity 1D to its Power Plant and the operator must make a Difficult (10+) operator check (DEX) to avoid a Critical Hit to the Drive System, with the negative Effect being the Severity of the Critical Hit. Additional checks based on the current situations might be needed to avoid an accident.

MORE AGILITY!

This modification will increase the Agility of the vehicle by +1. The vehicle must already have the Agility feature and this bonus costs three times the base Cost of the vehicle's Spaces.

OPTIMISED SECONDARY AND TERTIARY FEATURES

Added modes of locomotion, such as aquatic drives or auxiliary grav drives cannot usually take advantage of the vehicle's overall feature specialisations. If desired, these benefits can be added to alternate modes of transportation provided the features are compatible with those added to the primary locomotion system. Adding these features requires twice the cost to add to the primary locomotion mode and consumes 5% of a vehicle's Spaces (always at least one) in addition to any Spaces required by the feature.

BREAKING THE SOUND BARRIER

In general, only an aeroplane with the jet engines feature, a vehicle with the streamlined feature or an unstreamlined vehicle with rocket thrusters can exceed the speed of sound in an atmosphere. The addition of the streamlined feature has been addressed but for aeroplanes the requisite supersonic or hypersonic features require changes to the airframe, intakes for the engines and materials capable of withstanding the stresses. This can be done to a vehicle not designed for the task but the supersonic or hypersonic features are three times their normal Cost and only function under jet engine or rocket thrust power.

The resulting craft is sluggish at Supersonic speeds and above, gaining the Unresponsive trait, and suffers -1 to Agility at all Speed Bands.

These retrofitted vehicles are inherently unsafe. All tasks to control the vehicle suffer DM-2 and Effect -6 will result in an irrecoverable complete loss of control. The occupants might be able to eject but the aircraft will crash.

Additionally, on each flight, the Referee should roll 2D as the vehicle reaches each Mach number (this takes at least four rounds past the initial break of the sound barrier) with DM-1 when first reaching Supersonic speed. On a roll of 11+ the pilot must make a Difficult (10+) pilot check (DEX or INT) to maintain control. If the pilot loses control, additional checks can be made to regain it, with a cumulative DM-1 for each subsequent attempt. If any attempt results in Effect -6, the vehicle is completely out of control and the pilot must eject or crash. As the pilot struggles with control, the Referee should determine the rate at which the vehicle is falling and when it strikes the ground.

BIOTECH

The idea of a vehicle that can repair itself, grow its own ammunition and be powered purely by grazing organic material or gathering sunlight sounds like a dream but this is all possible with biotechnology. These are effectively living vehicles constructed of (or grown from) organic matter and, given a suitable technological base, can rival more traditional vehicles and even exceed their capabilities.

USING BIOTECH

Not every universe has or should have biotechnology capable of creating vehicles and it is up to the Referee whether it exists on the worlds they create. Biotechnology could be widespread and an accepted part of interstellar society or could be a lot rarer in some regions of the galaxy, with perhaps just one civilisation capable of using it to any great degree. However, even in a galaxy where biotechnology is largely unknown, it can often be fun to throw a vehicle created with these rules at the Travellers, perhaps as a relic from a long past age or the creation of a minor and relatively unknown alien species.

FACTORS TO CONSIDER

Biotech can be a fringe technology or central to certain civilisations. When introducing biotech vehicles in *Traveller*, the Referee should have a context in mind:

- Are they central to the civilisation's technology or a minor fringe element?
- Are they considered just another form of 'machine' and manufactured in biological factories or cloning vats?
- Are they intended to be 'herded', controlled by a trained handler, ridden or even inhabited?
- Are they completely controlled like a vehicle, or do they have instincts or intelligence?
- Do they have any legal protection or rights?
- Can they reproduce? If so, how? Is this how they are 'manufactured' or is it a side-effect or alternate means of (pro)creation?
- Do they have natural diseases or parasites?
- Are there biological weapons designed to specifically target them?
- Do they age? How quickly?

This chapter assumes a 'typical' *Traveller* universe where biotechnology is rare but possible and that biotech vehicles are treated more like vehicles with biological properties than biological entities with vehicle properties.

A biotech vehicle under these assumptions requires a society of at least TL10. However, it will always be constructed and function as being two Tech Levels lower. For example, a TL10 world could create a biotech vehicle that uses a maximum of TL8 components. This modification does not apply to any of the biotech weapons described later in this chapter. In universes where biotech is prevalent or in locations where biotech is prominent, the Tech Level of any item is completely arbitrary and very advanced biological systems might exist on primitive worlds. In universes where biotechnology is commonplace and well-understood, these restrictions can be ignored.

MECHANICS VS MEDICS

While biotech is fundamentally different than the technology of non-organic vehicles, it performs many of the same functions in similar ways and a bright mechanic can often figure out how to fix or modify a biotech vehicle, given sufficient time and motivation.

Any Mechanic checks made on a biotech vehicle suffer DM-4.

When a bio-tech vehicle needs repair or customisation, it is more practical to call a doctor! However, few medical schools teach their students how to perform the equivalent of an oil change on a bio-ATV. Medic checks made on a biotech vehicle suffer DM-2. A veterinarian has the advantage of working with a variety of life forms and an Animals (veterinary) check only suffers DM-1.

In universes where biotechnology is commonplace and well-understood, these penalties can be ignored. In any universe where biotechnology exists, there will be experts with Profession (biomechanic) who can work on these vehicles without penalty.

REPAIRS VS. HEALING

A damaged biotech vehicle can be repaired, although the different technologies involved can make this an expensive process. Double the Cost to repair a biotech vehicle. However, biotech vehicles have the advantage of re-growing damaged areas and can effectively repair themselves, given time.

A biotech vehicle that has not been rendered inert can 'regenerate' a lost Structure and remove one Critical Hit Severity to a single Critical Hit location per day. This is in addition to other repairs made by the vehicle's crew but will not regrow a weapon or other capability that has been completely destroyed.

DESIGNING BIOTECH VEHICLES

When creating bio-tech vehicles, the design checklist on page 27 is used as normal, with the following changes.

Chassis Type: Grav vehicles may not be chosen. Note that rotorcraft are more likely to be ornithopters.

Agility: All biotech vehicles have +1 Agility.

Cost per Space: Base Cost per Space is doubled for biotech vehicles.

Traits: Biotech vehicles must select either the Vertebrate or Invertebrate trait, and then either the Ectothermic or Endothermic trait.

BIOTECH TRAITS

The following traits are used for Biotech vehicles.

Ectothermic
This vehicle is 'cold-blooded'. It increases its Range by 25% but reduces speed by one Band.

Endothermic
This vehicle is 'warm-blooded' and grants DM+1 to any IR-based sensors that try to detect them.

Invertebrate
An Invertebrate vehicle relies on muscles and internal pressure to retain its shape. Invertebrate vehicles reduce their Cost per Space by 25% (after doubling for being a biotech vehicle) and reduce Hull by 10%.

Vertebrate
These vehicles have an internal skeletal structure that gives them strength and retains their shape. Vertebrate vehicles receive no special rules.

Fast Regenerator
This trait allows a biotech vehicle to heal at a faster rate. This trait can be applied up to three times, increasing the healing rate from once per day to once per 12 hours, six hours or three hours. Each application triples the Cost per Space of the vehicle. Vehicles that regenerate at the six hour or faster rate can also regenerate biotech items completely destroyed by Critical Hits.

OTHER LIMITATIONS

A biotech vehicle can do most of what a mechanical vehicle can, although not necessarily in the same manner. This introduces changes and limitations to rules designed for a mechanically based vehicle.

Power Plants: A biotech vehicle cannot use nuclear power plants of any kind. By default, it is a powered vehicle.

Auxiliary Drives: Biotech vehicles cannot use grav drives or lifters.

Armour: While armour used on biotech vehicles can be extremely tough, it is generally not quite as capable at resisting damage as exotic non-organic materials. Armour protection for biotech vehicles cannot progress past the equivalent of TL10 crystaliron.

Camouflage and Stealth: Biotech vehicles inflict an additional DM-1 to be detected by all methods except those using infrared, in which case sensors receive DM+1. Note that this applies even if they do not have a camouflage or stealth customisation. Camouflage options are available at two Tech Levels lower than for non-biotech vehicles, although holographic hulls are not available.

Environmental Protection: All such customisations including life support and biospheres have their Cost halved and duration doubled. A biotech vehicle with insidious environment protection is assumed to be compatible with the insidious ecosystem and its protection will not fail after a set number of days, nor need to be reapplied.

Meson Communicator: This cannot be used in biotech vehicles.

Navigation Systems: Biotech versions grant an additional DM+1 to Navigation checks and have their Cost halved.

Sensors: All sensors are doubled in price and have their range halved, except those used underwater. These are doubled in Cost but gain DM+2 to all Electronics (sensors) checks made when using them.

Internal Bays and Hangars: It is possible for a biotech vehicle to carry other vehicles inside it. These can use the normal options, although the Referee can rule that a biotech vehicle that functions as a symbiote does not require any extra Spaces beyond its own Shipping tons, even if it can detach from the larger vehicle.

Nonorganic & Biotech Customisation: Enterprising engineers can try to combine non-organic and biotech in their vehicles, either installing bio-tech components into a non-organic vehicle, or vice versa. While this is entirely possible, it is rarely easy due to fundamental differences between technologies. When installing non-organic items into a biotech vehicle (or vice versa), quadruple all costs after other modifiers are applied.

BIOTECH WEAPON SYSTEMS

While non-organic weapons can be mounted on a biotech vehicle, dedicated biotech weapons not only have the advantage of direct compatibility but are also either directly powered by the vehicle's own systems or actually grow their own ammunition. This means that so long as the vehicle is kept refuelled, it never run out of ammunition.

Biotech weapons regrow expended ammunition within a day or at an accelerated rate if the vehicle is a Fast Regenerator (see page 132). A biotech vehicle can use its weapons without gunners but is subject to the same multi-tasking penalties as a Traveller when firing multiple weapons at once or performing other Major Actions.

ARC CANNON

This weapon fires an extremely powerful electrical discharge that blasts apart organic matter and penetrates even hardened armour. While short-ranged, it remains extremely potent, especially when mounted on board a stealth-capable biotech vehicle.

BIOLASER

This is a chemical laser weapon, using enhanced bioluminescent proteins as the lasing medium. Even the optical chambers and mirrors are biotech in origin and the biolaser is at least as capable as its non-organic equivalents. Truly massive versions of the biolaser are possible, although they require over-sized biotech vehicles to house them.

BOMBARDIER CANNON

Effectively a biotech-based mortar, the bombardier cannon uses volatile chemicals to launch a highly explosive payload through the air.

FIRE BREATH

Just as it sounds, this weapon gives the biotech vehicle the ability to breathe fire. The spray of fiery breath is a combination of gases expelled and ignited by a mechanism in the vehicle's 'mouth' or 'nose'. This weapon is a short ranged antipersonnel weapon but also useful for setting fire to buildings constructed of flammable material.

FLAME SPITTER

This weapon launches balls of incendiary material that ignite on contact with an oxygen atmosphere. It is effective against light vehicles and infantry, although armoured vehicles have little to fear.

NATURAL WEAPONS

Some biotech vehicles have weapons akin to natural creatures, including teeth, claws and horns. Damage is determined by the Spaces of the biotech vehicle to a maximum of 1DD.

Natural Weapon Damage

Size (Spaces)	Damage
1–2	1D
3–4	2D
5–8	3D
9–14	4D
15–22	5D
23–32	6D
33+	+1D for every 32 Spaces

Horns and Teeth can be considered an integral part of the biotech vehicle and included in its base Cost. Claws can be attached to manipulator arms or a walker's feet. Coatings to these weapons increase their effectiveness.

Cost is per Space per weapon, so adding four monofilament claws to a 10 Space biotech vehicle would cost Cr200000. The first four natural weapon attack vectors (two limbs, teeth, horns) consume no extra Spaces. Beyond this, each additional natural weapon attack consumes 10% of the vehicle's Spaces.

BIOTECH WEAPONS

Weapon	TL	Range (km)	Damage	Tons	Spaces	Cost
Arc Cannon	11	0.5	1DD	2	8	Cr120000
Biolaser (light)	14	1	5D	0.25	1	Cr60000
Biolaser (medium)	14	3	1DD	1	4	Cr600000
Biolaser (heavy)	14	10	2DD	8	32	MCr2
Biolaser (very heavy)	14	20	3DD	16	64	MCr6
Bombardier Cannon	10	5	8D	2.5	10	Cr60000
Fire Breath	10	0.02	4D	0.25	1	Cr10000
Flame Spitter	10	0.5	3D+3	3	12	Cr20000
Scything Claw (small)	10	Melee	3D	0.25	1	Cr20000
Scything Claw (light)	10	Melee	5D	1	4	Cr50000
Scything Claw (heavy)	10	Melee	1DD	4	16	Cr200000
Scything Claw (huge)	10	Melee	2DD	8	24	Cr500000
Scything Claw (massive)	10	Melee	3DD	24	96	MCr1.5
Sonic Screamer	11	1	8D	2	8	Cr150000
Sonic Stun Screamer	12	0.1	4D	2	8	Cr150000
Spore Mortar	12	4	5D	1	4	Cr25000
Swarm Cannon	12	1	7D	1	4	Cr60000

Natural Weapon Coatings

Coating	TL	Damage Bonus	Traits	Cost per Vehicle Space
Hardened	10	+1 per D	AP 2	Cr1000
Edging	11	+1 per D	AP 4	Cr3000
Monofilament	12	+2 per D	AP 10	Cr5000
Arc-field	14	+2 per D	AP 30	Cr25000

RAM

A biotech ram is a hardened horn designed to penetrate a target and functions in the same manner as a non-organic metal-tipped ram. See Ram on page. 71 for more information.

SCYTHING CLAW

This weapon takes the form of a massive claw that, by virtue of weight and power, can rip through the thickest armour with ease. Soldiers have reported vehicles armed with scything claws peeling grav tanks apart as if they were tin cans. While limited in range, a biotech vehicle with such claws is a vicious weapon in urban environments or close assaults. The size of a scything claw is related to the Size of the vehicle, so a Light vehicle can only have a light or small claw and so on. Attacks by scything claws are instinctive and attack anyone within range of a claw without requiring an action or operator.

At TL12, a scything claw can grow and maintain a monofilament-thin edge, giving it +1 damage per damage dice and +5 to its AP trait. This doubles the claw's Cost. A scything claw is already considered to have hardened edging by default and cannot use arc-field coatings.

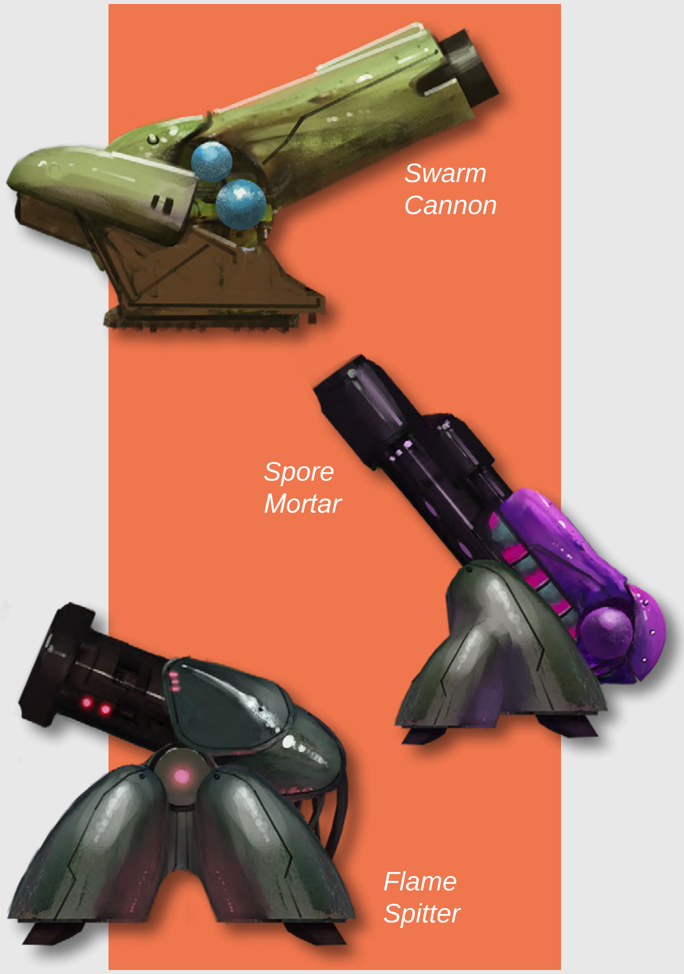
SONIC SCREAMER

Using focused sonic waves to inflict damage, the screamer is designed for use against organic targets, including other biotech vehicles. While devastating against 'soft' targets, the sonic screamer halves all damage against nonorganic targets.

SONIC STUN SCREAMER

A broad-band version of the sonic screamer inflicts Stun damage to large crowds, attacking every target in a 90° arc up to 50 metres away at full strength and up to 100 metres at half strength.

	Magazine				
Traits	**Rounds**	**Cost**	**Rounds/ Space**	**Crew**	**Loaders**
AP 10	—	—	—	1	—
AP 5	—	—	—	1	—
AP 10	—	—	—	1	—
AP 20	—	—	—	1	—
AP 25	—	—	—	1	—
Artillery, Blast 10	30	—	600	1	—
Blast 3, Fire	30	—	6,000	1	—
Blast 8, Fire	60	—	1,000	1	—
AP 5	—	—	—	—	—
AP 10	—	—	—	—	—
AP 20	—	—	—	—	—
AP 25	—	—	—	—	—
AP 30	—	—	—	—	—
Blast 12	—	—	—	1	—
Blast special, Stun	—	—	—	1	—
Blast 8	7	—	350	1	—
Artillery, Blast 10, Smart	30	—	1,500	1	—



SPORE MORTAR

This squat weapon throws large spore pods across large distances, where they explode and release deadly spores into the air that quickly infect any organic life forms close by, effectively eating away their flesh in seconds. The spore mortar does not affect vehicles or anyone in sealed suits.

SWARM CANNON

The swarm cannon grows tiny insects with metallic shells at a tremendous rate and then propels them with great speed and in large numbers towards a target. This swarm can correct its flight, making it deadly accurate.

OTHER FACTORS

This section is a review of the questions posed at the beginning of this chapter and provides guidance and ideas of a universe where biotech vehicles and biotechnology are more common.

PREVALENCE

> *Are they central to the civilisation’s technology or a minor fringe element?*

The assumption for biotech is that it is a peripheral element and would be viewed as a novelty or specialised technology. In other societies all technology could be biological in nature and the Tech Level limitation and values given for even 'mundane' options in biological form are not relevant. The entire society could be at a low 'mechanical technology' level, even TL0, but have sophisticated biotech machines, bred or tamed, capable of feats another civilisation would struggle to achieve at TL10 or higher.

> *Are they considered just another form of 'machine' and manufactured in biological factories with cloning vats, or are they specially bred 'animals' using more natural processes.*

The answer to this question does not necessarily relate to the non-biological technology of the society. If all biotech vehicles are grown in bioreactor vats, then it is likely that other technical aspects of the society are sophisticated but even if the society is capable of starflight, it might have adopted or adapted more natural processes and timelines to create biotech machines.

BIOTECH VEHICLE BEHAVIOUR

> *Are they intended to be 'herded', controlled by a trained handler, ridden or inhabited?*

All of the above can be true but those with internal crews might require more imagination and attention. It is possible that even a large biological vehicle – the size of a sandworm on Dune – could be ridden but never 'inhabited'. In other cases, especially in biotech vehicles intended for hostile environments, the entire crew is internal to the vehicle in cavities with life support.

> *Are they completely controlled like a vehicle or do they have instincts or intelligence?*

A biotech vehicle is alive and has at least a rudimentary nervous system. By default, this grants the vehicle Autopilot (improved), or the equivalent of skill level 1 in whatever skill is appropriate for its locomotion. If it has limbs, these will react to threats with any claws or defensive weapons available. Without guidance, it will react with a fight or flight reflex (see the *Traveller Core Rulebook* page 90). The type of animal that best fits the biotech vehicle's behaviour can be specified and put in its description.

A biotech vehicle starts with animal-level intelligence. It is either trained or conditioned to obey commands of a 'driver' or 'handler'. Essentially, it has an INT and EDU of 0. This can be improved by either the simple method detailed here or by building the equivalent of a robot brain using the rules starting on page 65 of the *Robot Handbook*. If the biotech vehicle is smart enough, it can be treated as another character or even a Traveller. This might conflict with its driver. More complicated matters such as biotech vehicle rights and ownership are something for the Referee to resolve.

A simplified biotech brain creation process is as follows:

Each point of INT costs:
- Cr50000 up to INT 8.
- Cr200000 per point up to INT 12.
- Cr500000 per point above 12.
- The maximum INT is equal to the Tech Level of the biotech vehicle.

> *For example, at TL10 a biotech vehicle could have a brain with INT 10, at a cost of Cr400000 to INT 8, plus another Cr400000 to raise it to 10, for a total of Cr800000.*

Skills, personality, EDU and other peculiarities of an independent-minded biotech vehicle are up to the discretion of the Referee and should fit within the universe.

> *Do they have any legal protection or rights?*

In an 'ideal' context, the strength of protections or rights of a biotech vehicle might be in inverse proportion to its intelligence but different societies have different philosophies and even in societies where sophonts are protected from slavery, such as the Third Imperium, the definition of sophonts, especially of created beings, can be interpreted in such a way to limit or remove rights from an intelligent biotech vehicle.

The Referee should at least consider a framework, even if the framework is 'they have no rights'. That framework can have implications on how the vehicles are used, who can 'own' them – or is it a contract between two parties for services (e.g. transport, protection, housing) offered.

> *Can they reproduce? If so, how? Is this how they are 'manufactured' or is it a side-effect or alternate means of (pro)creation?*

If a biotech vehicle is a product sold by a corporation for profit, it is not likely to be able to reproduce on its own, although some companies might be willing to sell a 'commercial license' to a remote colony just beginning settlement, for local use only or for a limited number of generations. A manufactured biotech vehicle is unlikely to have any gendered features or behaviours linking to reproduction (the mating season and dominance displays of heavy biotech hauling vehicles might be interesting but only from a distance). Biotech modified from a natural template might be more difficult to fully 'neuter' but humans have been able to handle neutered or sterile versions of domestic animals since before the advent of writing.

The actual production process of biotech products need not produce 'adult versions'. A smaller immature or embryonic version of the vehicle, either a miniature of the full-sized adult, a seed, chrysalis form, or even a larval organism might be easier to manufacture, store and transport than a full-sized vehicle. Adding nutrients, chemicals or some other trigger might initiate transformation into an adult, although at best twice the volume of nutrients would be necessary for one volume of growing vehicle, and waste products will need to be disposed of.

Growth can take time, with a general principle that a faster 'gestation' is likely to lead to a shorter lifespan. Rather than develop questionable formulas for growth rates and lifespans, the Referee should establish something that fits within the economy of the biotech-producing society; either too fast or too slow gestation periods and lifetimes could overwhelm the society or make biotech too resource- and time-intensive to be worthwhile.

SICKNESS AND AGING

Do they have natural diseases or parasites?

Diseases on page 80 of the *Traveller Core Rulebook,* or the more in-depth treatment starting on page 71 of the *Traveller Companion*, can form the basis of a natural disease or parasitic infection of a biotech vehicle. Rather than determining an END characteristic, the Referee determines that the vehicle suffers from a disease and applies damage to it, with the potential for Critical Hits at every Structure interval causing additional effects. A medic or veterinarian with the proper drugs can aid recovery of the vehicle as if it were a patient; the minutiae of surgery and bed rest are unnecessary complications. A biotech vehicle could benefit from a healing symbiote.

Are there biological weapons designed to specifically target them?

These can be treated in the same manner as diseases or toxins. However, it is also possible to turn this question on its head; are there biological agents that can target other vehicles? For instance, a bioweapon that can consume metals or plastics or fuel – these can be treated as illnesses or toxins affecting mechanical vehicles in the same way as a biological attack on a biological vehicle.

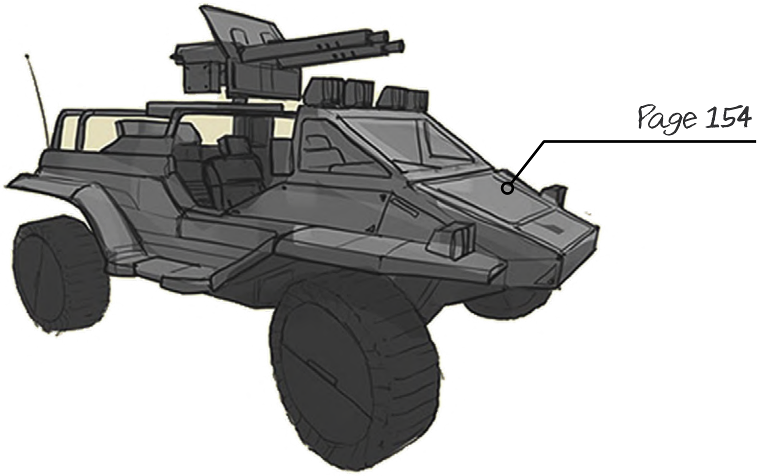
Do they age? How fast?

Many trees can live for thousands of years; mayflies and midges do not last a full day in their adult form. The lifespan of a biotech vehicle, especially one capable of regenerating, can be longer than that of most mechanical devices. Others might have planned obsolescence built in, with a set lifespan, perhaps extended if the purchaser pays for an 'extended warrantee' package. If the biotech vehicle is adapted from a natural living being, it is more likely to have a similar lifespan and most animals capable of reproduction tend to age to make way for the new generation. This matter is one where the Referee has considerable freedom to decide based on what makes sense in the universe but it seems unlikely that a vehicle with a lifespan of less than a year would be something worth creating, unless it was intended as a disposable weapon.

FINAL THOUGHTS

Also consider looking at Augments in the *Central Supply Catalogue* and Special Robots and Other Synthetics in the *Robot Handbook* for inspiration. Outside those sections, any items in either of these books could be considered in a biological context, with the possible exception of nuclear power.

The vehicle design procedures in conjunction with biotech can also be used to create non-vehicle biologically based beings; 'monsters' such as Kaiju, floating herds of gas-bag creatures, even a sandworm. Because a vehicle at 'human' scale (one Space) has very little Structure, any animal-like creature designed with these rules should use the Vehicle Combat rules to give it more armour against personal weapons with a Tech Level modifier perhaps determined arbitrarily. Critical Hits can also be used for hostile encounters with these creations, although the Referee might need to creatively interpret some of the results.



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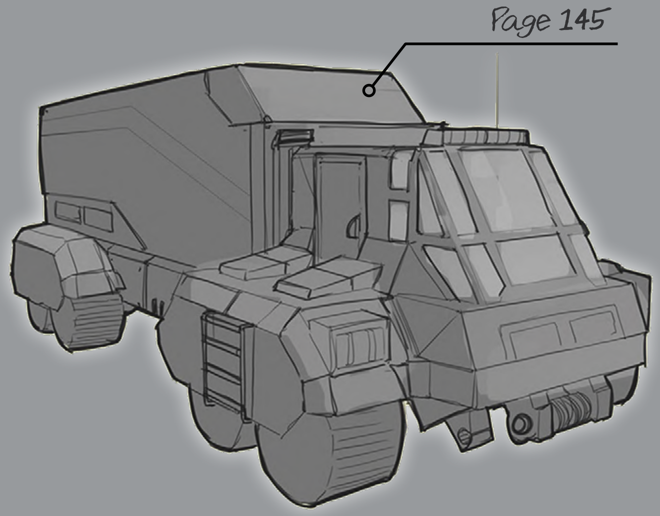
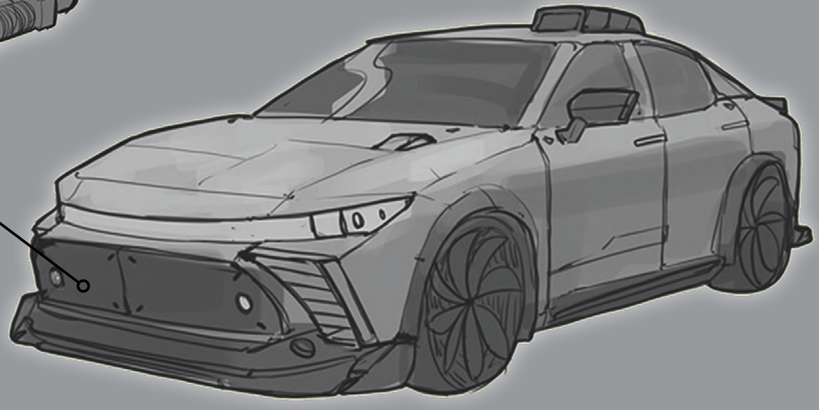
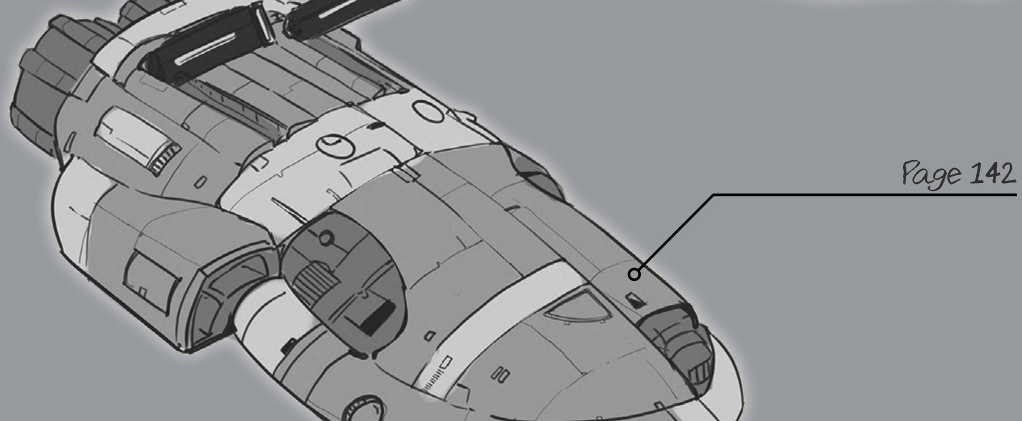
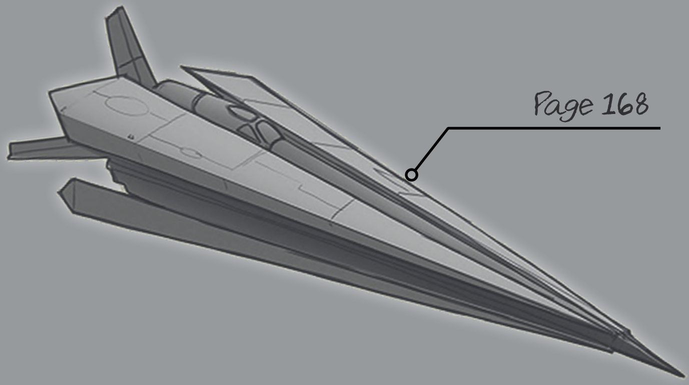






VEHICLE CATALOGUE



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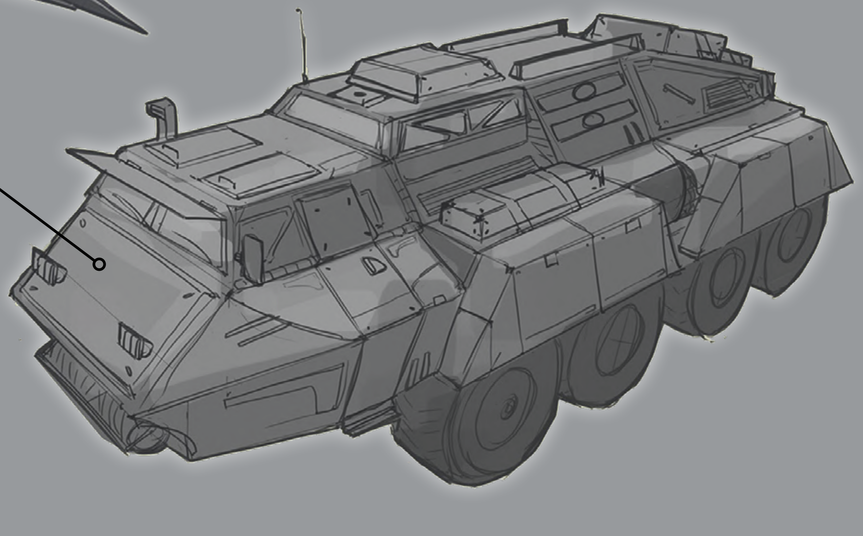

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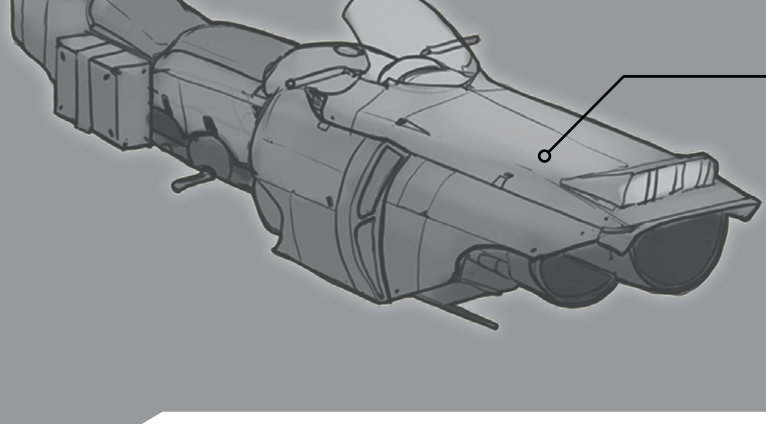

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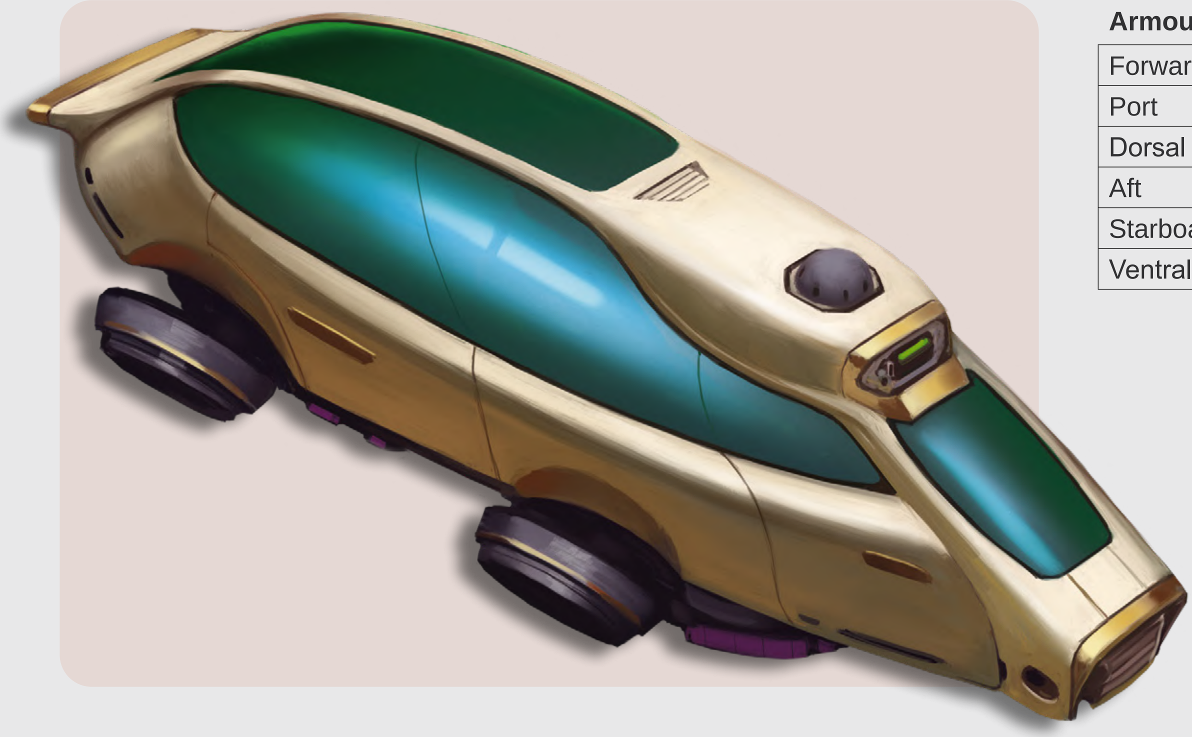
AEROCAR SUPERTAXI

Designed to provide fast luxury transport to those desiring to own and operate a flying car on worlds where grav vehicles are not yet available, the Aerocar is a vectored jet thrust aerodyne with full ground driving system. Its autopilot is fully capable of autonomous flying and driving but controls are installed to allow manual operation.

The vehicle's safety system includes a complete parachute system and advanced airbags to allow survivability, and the luxurious interior is equipped with a top grade entertainment system to support excursions that can cross 3,000 kilometres in as little as six hours.

TYPE: Light Rotorcraft (6 Spaces, DM+1 to hit)
FEATURES AND TRAITS: Aerodyne, Streamlined, VTOL

TL	8
SKILL	Flyer (rotor)
AGILITY	+2
SPEED (CRUISE)	Very Fast (Fast)
RANGE (CRUISE)	2,000 (3,000)
CREW, PASSENGERS	1, 2
COMFORT LEVEL	Standard Comfort
CARGO	0.25 tons
STRUCTURE	1
SHIPPING	3 tons
COST	Cr550000



Armour

Forward	3 (11)
Port	3 (11)
Dorsal	3 (11)
Aft	3 (11)
Starboard	3 (11)
Ventral	3 (11)

EQUIPMENT

Autopilot (improved), Collision Protection (basic) x3, Computer/1, Control System (improved), Entertainment System x10, Ground Drive (Medium, 250km), Luxury Interior Space (improved) x3, Navigation System (basic), Pressurised Hull, Sensor System (basic), Transceiver (improved), Vehicle Parachute (improved)	Autopilot (skill level)	+1
	Communications (range)	500km, satellite uplink
	Navigation (Navigation DM)	+1
	Sensors (Electronics (sensors) DM)	+0, 1km
	Camouflage (Recon DM)	—
	Stealth (Electronics (sensors) DM)	—

AIR/RAFT

Open-topped vehicles supported by anti-gravity technology, air/rafts are capable of reaching orbit but passengers must wear vacc suits. They are ubiquitous, remarkably reliable and flexible vehicles.

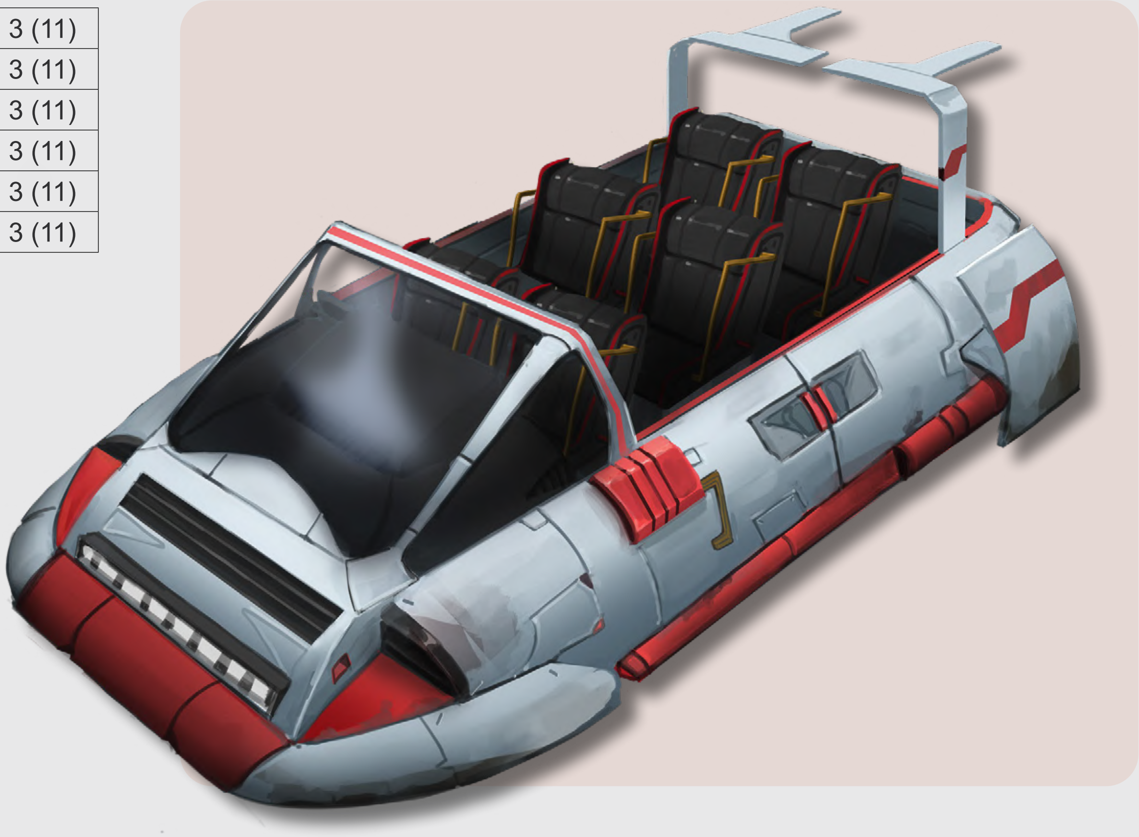
A cargo carrying version of the air/raft is available, with Crew: 1, Passengers: 0 and Cargo: 1.5 ton.

TYPE: Light Grav Vehicle (8 Spaces, DM+1 to hit)
FEATURES AND TRAITS: Open-Topped, VTOL

TL	8
SKILL	Flyer (grav)
AGILITY	+1
SPEED (CRUISE)	High (Medium)
RANGE (CRUISE)	2,000 (3,000)
CREW, PASSENGERS	1, 5
COMFORT LEVEL	Basic Seating
CARGO	0.25 tons
STRUCTURE	2
SHIPPING	4 tons
COST	Cr250000

Armour

Forward	3 (11)
Port	3 (11)
Dorsal	3 (11)
Aft	3 (11)
Starboard	3 (11)
Ventral	3 (11)



EQUIPMENT

Autopilot (improved), Collision Protection (basic) x8, Computer/1, Control System (basic), Entertainment System, Navigation System (basic), Sensor System (basic), Transceiver (improved)	Autopilot (skill level)	+1
	Communications (range)	500km, satellite uplink
	Navigation (Navigation DM)	+1
	Sensors (Electronics (sensors) DM)	+0, 1km
	Camouflage (Recon DM)	—
	Stealth (Electronics (sensors) DM)	—

ARCHANGEL HEAVY SKYFIGHTER

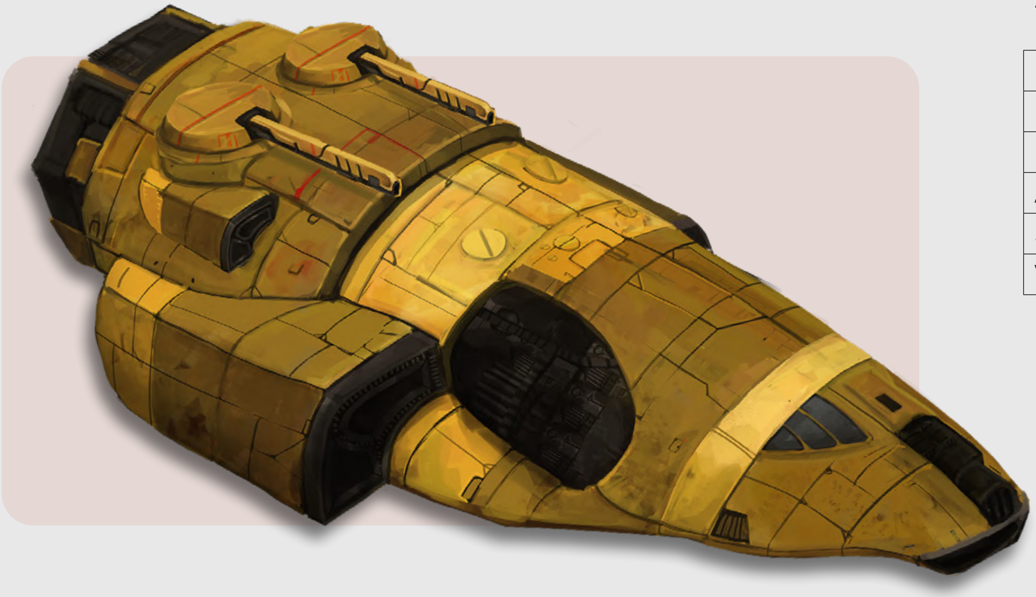
The Archangel is what some would call a 'battlecruiser of the sky'. Armed with a double heavy pulse laser turret and capable of reaching space, the Archangel can defend orbital assets, reach the far corners of a world in less than an hour and linger over a target for days. For long-duration missions, the Archangel can fly uncrewed as a drone or with an autonomous combat vehicle brain, and the vehicle's autopilot and fire-control system for flight and combat operations, but it tends to perform better with a well-trained crew.

TYPE: Heavy Grav Vehicle (70 Spaces, DM+2 to hit) Reinforced Hull
FEATURES AND TRAITS: Agile, Fast, Responsive, Streamlined, VTOL

TL	9
SKILL	Flyer (grav)
AGILITY	+3
SPEED (CRUISE)	Hypersonic (Supersonic)
RANGE (CRUISE)	29 years
CREW	2
COMFORT LEVEL	Basic Comfort
CARGO	—
STRUCTURE	16
SHIPPING	35 tons
COST	MCr35.4

Armour
Reactive Armour +25

Forward	32 (41)
Port	20 (29)
Dorsal	12 (21)
Aft	12 (21)
Starboard	20 (29)
Ventral	12 (21)



EQUIPMENT

Autopilot (enhanced), Bunk, Camouflage (improved), Combat Vehicle Brain (basic), Computer/1, Control System (improved), Drone Actuators, Fire Extinguishers, Fresher (half), Fusion (basic, PP 12.5), Life Support (long term), Navigation System (improved), Reactive Armour (improved), Sensor System (improved), Stealth (improved), Transceiver (improved), Vacuum Environment Protection	Autopilot (skill level)	+2
	Communications (range)	50,000km, tightbeam, encrypted
	Navigation (Navigation DM)	+2
	Sensors (Electronics (sensors) DM)	+2, 5,000km, high fidelity, hardened
	Camouflage (Recon DM)	-2, 200m min range, visual, IR
	Stealth (Electronics (sensors) DM)	-2

Weapons	Range	Damage	Magazine	Cost	Traits	Fire Control
Turret: Dorsal, Pulse Laser Gun (heavy) [F6] x2	20	3DD+30	—	—	AP 6, Scope	+2

ASSAULT MONOCYCLE

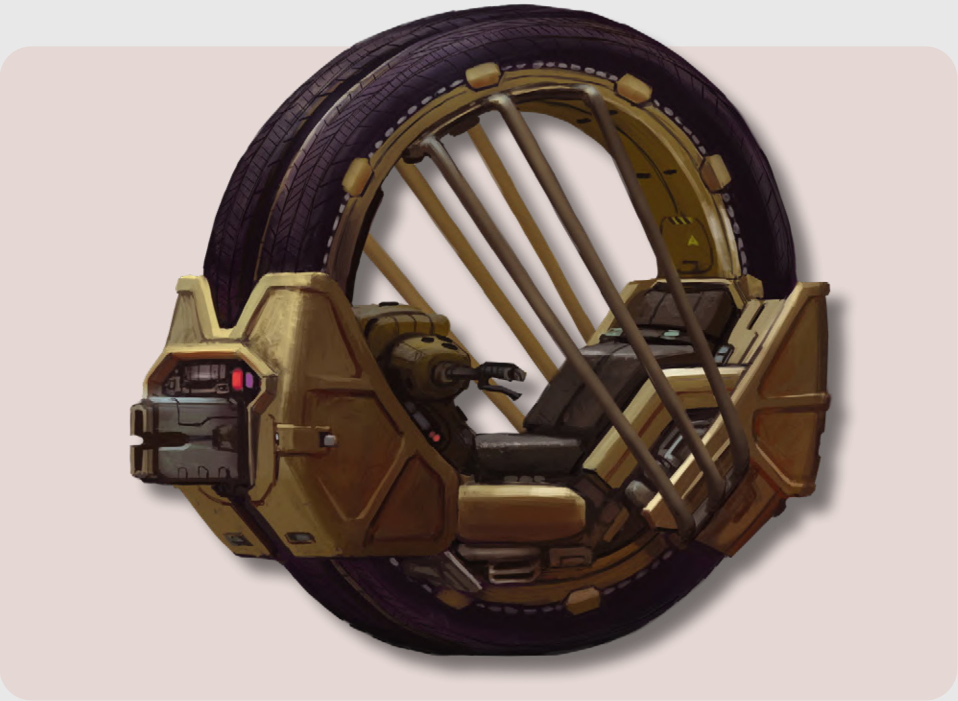
The assault monocycle is a very lightweight one-person attack vehicle, designed to provide cheap but fast and hard-hitting strike capabilities to mercenary forces. While it tends to disintegrate under enemy fire, its speed and agility enable a skilled rider to keep it out of trouble, while its weaponry means it cannot be simply ignored.

TYPE: Small Ground Vehicle (2 Spaces, DM+0 to hit)
FEATURES AND TRAITS: Fast, Monowheel, Smart Wheels

TL	9
SKILL	Drive (wheel)
AGILITY	+4
SPEED (CRUISE)	Very Fast (Fast)
RANGE (CRUISE)	440 (660)
CREW	1
COMFORT LEVEL	Basic Seating
CARGO	—
STRUCTURE	1
SHIPPING	0.5 tons
COST	Cr23000

Armour

Forward	3 (12)
Port	3 (12)
Dorsal	3 (12)
Aft	3 (12)
Starboard	3 (12)
Ventral	3 (12)



EQUIPMENT

Autopilot (basic), Control System (improved), Transceiver (improved)	Autopilot (skill level)	+0
	Communications (range)	500km
	Navigation (Navigation DM)	—
	Sensors (Electronics (sensors) DM)	—
	Camouflage (Recon DM)	—
	Stealth (Electronics (sensors) DM)	—

Weapons	Range	Damage	Magazine	Cost	Traits	Fire Control
Fixed Mount: Forward, Laser Rifle x2	0.2	5D+5	100	Cr1500	Scope, Zero-G	+0

ALL TERRAIN VEHICLE (ATV)

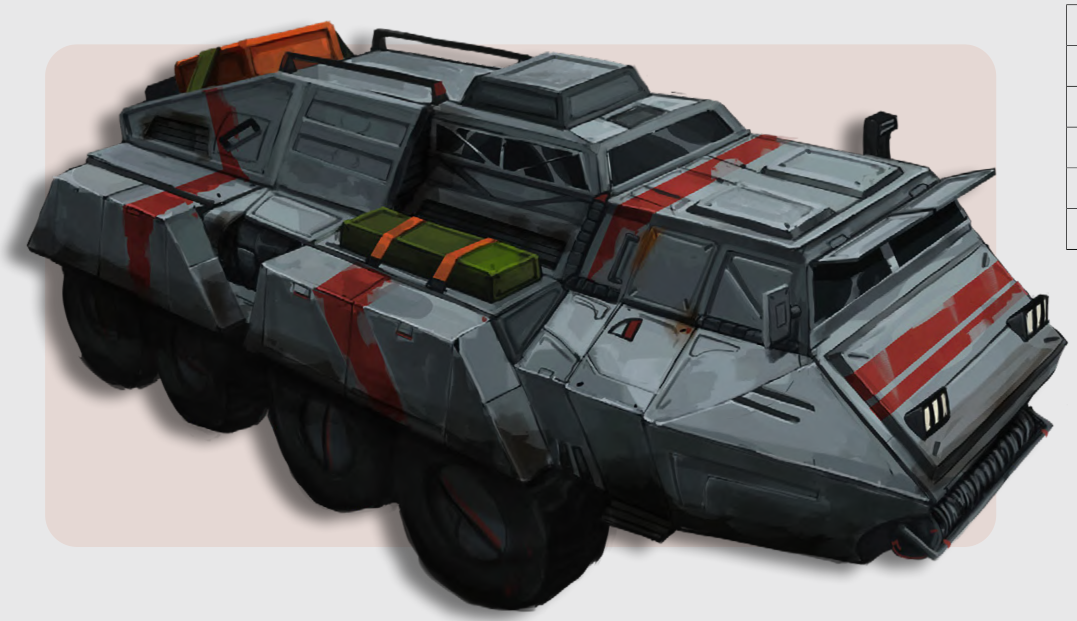
A very common enclosed, pressurised all-terrain ground vehicle. The vehicle is capable of crossing calm water and has a suite of built-in sensors and communication equipment (usually a laser transceiver) making it ideal for exploration. Equipped with an airlock, fresher, mini-galley and bunks for four, it can support a four-day expedition on nearly any world. The Fusion+ engine can be refuelled with just water. An ATV has a hardpoint for a turret but does not normally come with a weapon.

A tracked version of the ATV is available. This uses the Drive (track) skill, has Speed: Medium (Slow) and costs Cr175000.

TYPE: Heavy Ground Vehicle (20 Spaces, DM+2 to hit)
FEATURES AND TRAITS: ATV, Fast

TL	12
SKILL	Drive (wheel)
AGILITY	+0
SPEED (CRUISE)	High (Medium)
RANGE (CRUISE)	1,250 (1,880)
CREW, PASSENGERS	1, 7
COMFORT LEVEL	Extended Seating
CARGO	1.5 tons
STRUCTURE	4
SHIPPING	10 tons
COST	Cr155000

Armour	
Forward	6 (18)
Port	6 (18)
Dorsal	6 (18)
Aft	6 (18)
Starboard	6 (18)
Ventral	6 (18)



EQUIPMENT

Air Lock, Aquatic Drive (Very Slow, 600km), Autopilot (basic), Bunk x2, Collision Protection (improved) x16, Computer/1, Control System (improved), Fire Extinguishers, Fresher (standard), Fusion+ (basic) PP 2, Galley (mini), Life Support (short term), Navigation System (improved), Sensor System (improved), Transceiver (superior), Vacuum Environment Protection	Autopilot (skill level)	+0
	Communications (range)	500km, tightbeam, satellite uplink, encrypted
	Navigation (Navigation DM)	+2
	Sensors (Electronics (sensors) DM)	+1, 5km
	Camouflage (Recon DM)	—
	Stealth (Electronics (sensors) DM)	—

Weapons	Range	Damage	Magazine	Cost	Traits	Fire Control
Turret: Dorsal, can hold 4 Spaces of weapons	—	—	—	—	—	—

BRUTUS HEAVY CARGO TRUCK

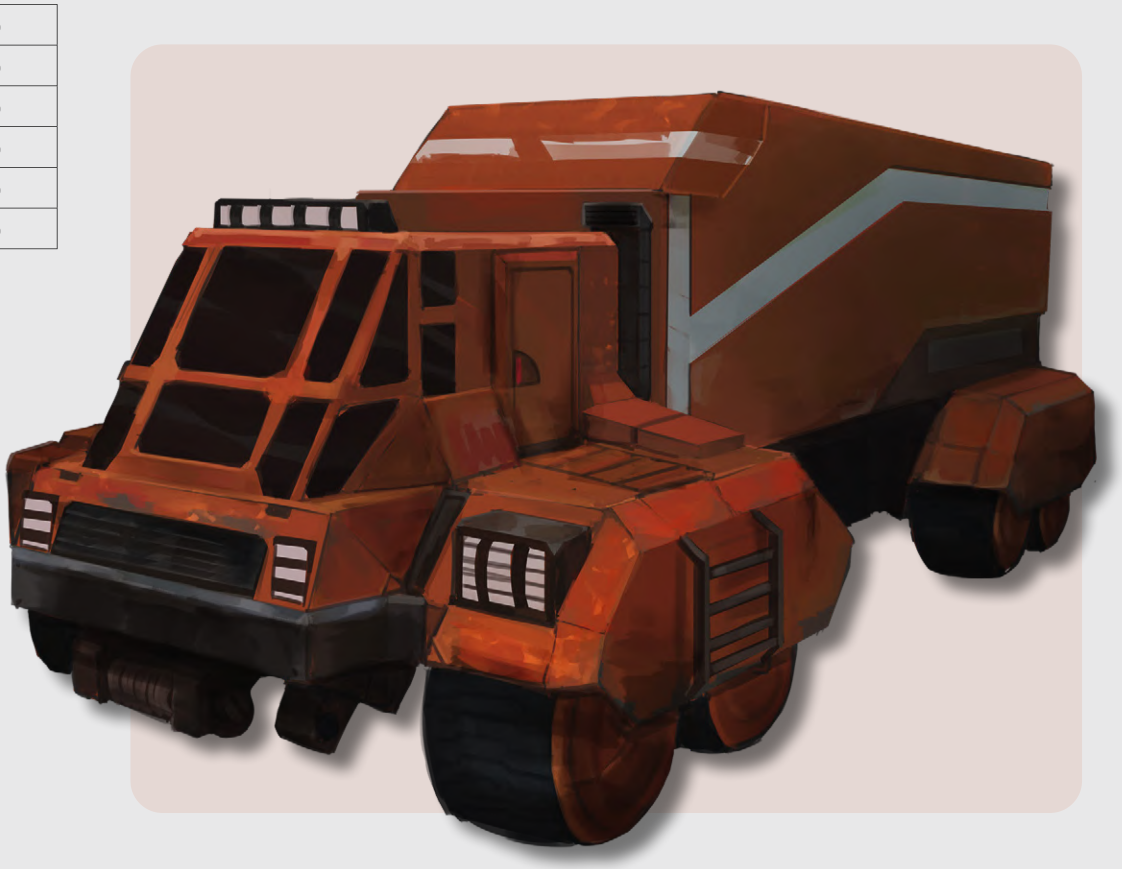
While lacking the glamour of armoured vehicles and aircraft, the ability to deliver supplies and ammunition to forward bases, not to mention shipping out wounded, is a fundamental requirement for any mercenary force not wanting to rely on their employers. This truck is large, built with the assumption that a mercenary force needs the greatest carrying capability within as few separate vehicles as possible.

TYPE: Heavy Ground Vehicle (80 Spaces, DM+2 to hit) Reinforced Hull
FEATURES AND TRAITS: Off-Roader

TL	10
SKILL	Drive (wheel)
AGILITY	+0
SPEED (CRUISE)	Medium (Slow)
RANGE (CRUISE)	1,000 (1,500)
CREW, PASSENGERS	1, 2
COMFORT LEVEL	Basic Seating
CARGO	15.5 tons
STRUCTURE	18
SHIPPING	40 tons
COST	Cr210000

Armour

Forward	8 (18)
Port	8 (18)
Dorsal	6 (16)
Aft	8 (18)
Starboard	8 (18)
Ventral	6 (16)



EQUIPMENT

Autopilot (improved), Camouflage (basic), Control System (improved), Crane (medium), Navigation System (improved), Transceiver (superior), Winch	Autopilot (skill level)	+1
	Communications (range)	500km, tightbeam, satellite uplink, encrypted
	Navigation (Navigation DM)	+2
	Sensors (Electronics (sensors) DM)	—
	Camouflage (Recon DM)	-2,500m min range, visual
	Stealth (Electronics (sensors) DM)	—

DESTROYER

The destroyer performs anti-submarine, anti-air, surface warfare and limited shore bombardment roles. Its main weapons are five guns in turrets and 10 torpedo tubes, while 12 ring mounts with autocannon and machineguns add anti-air capabilities. Medical capabilities are extremely limited, as the ship depends on a fleet doctor for severe injuries or chronic care.

TYPE: Massive Watercraft (4,000 Spaces, DM+6 to hit)
FEATURES AND TRAITS: Agile, Fast, Unresponsive

TL	5
SKILL	Seafarer (ocean ships)
AGILITY	-5
SPEED (CRUISE)	Slow (Very Slow)
RANGE (CRUISE)	6,880 (10,300)
CREW	330
COMFORT LEVEL	Basic Comfort
CARGO	250 tons; 22 Shipping tons docking capacity (or 25 tons for cargo)
STRUCTURE	800
SHIPPING	2,000 tons
COST	MCr47.2

Armour

Forward	20 (25)	Aft	16 (21)
Port	23 (28)	Starboard	23 (28)
Dorsal	10 (15)	Ventral	10 (15)

EQUIPMENT	
Ammunition Storage: 134 Spaces [light field gun: 1,250 rounds; light autocannon: 60,000 rounds; heavy machinegun: 720,000 rounds; Torpedo (basic): 10 rounds; light bomb: 32 rounds], Autopilot (basic), Bunk x240, Common Space x67, Control System (basic), Crane (medium), Docking Clamp (Type Zero) x2, Fire Director System (basic, +1), Fresher (standard) x30, Galley (full) x12, Medical Bay: Bed x3, Medical Bay: Cabinet, Navigation System (basic), Sensor System (basic), Sensor System (basic, underwater), Sleeping Berth x87, Stateroom (basic) x3, Transceiver (basic), Workshop x6	
Autopilot (skill level)	+0
Communications (range)	50km
Navigation (Navigation DM)	+1
Sensors (Electronics (sensors) DM)	+1, 10km, high fidelity; Underwater: +1,5km, high fidelity
Camouflage (Recon DM)	—
Stealth (Electronics (sensors) DM)	—

Weapons	Range	Damage	Magazine	Cost	Traits	Fire Control
Turret x5: Dorsal, Field Gun (light)	9	8D	1	Cr200	AP 5, Artillery, Blast 10, Scope	+0
Ring Mount x6: Dorsal, Autocannon (light) x2, gun shield +12	1	6D+6	500	Cr1000	Auto 3, Scope	+0
Ring Mount x6: Dorsal, Machinegun (heavy) x4, gun shield +12	1	5D+15	100	Cr400	Auto 3, Scope	+0
Bay x5: Port, Torpedo (basic)	5	3DD	—	—	AP 30, One Use, Smart	+0
Bay x5: Starboard, Torpedo (basic)	5	3DD	—	—	AP 30, One Use, Smart	+0
Hardpoint x4: Aft, Bomb (light)	—	1DD	—	—	AP 20, Blast 20, One Use	+0

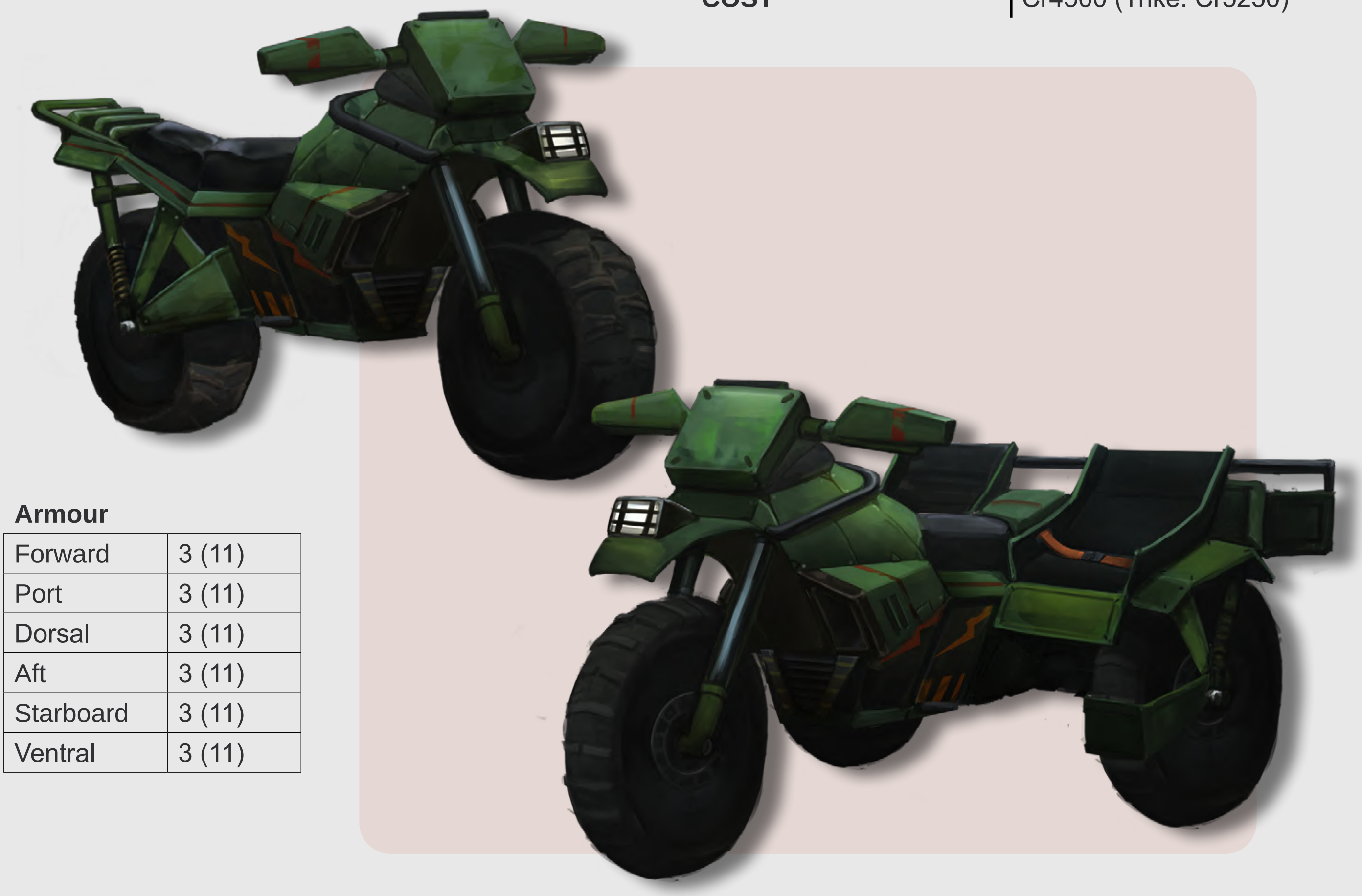
DIRT BIKE

Electrically powered, this dirt bike features simple, rugged construction, making it easy to keep in service with little more than a thorough clean after use. It is extremely durable and high efficiency batteries provide a decent range after a full recharge.

A three-wheeled trike version can seat two passengers or half a ton of cargo on a back bench with removable bucket seats and costs Cr5250.

TYPE: Small Ground Vehicle (2 Spaces, DM+0 to hit) (Trike = 3 Spaces)
FEATURES AND TRAITS: ATV, Open Frame

TL	8
SKILL	Drive (wheel)
AGILITY	+1
SPEED (CRUISE)	High (Medium)
RANGE (CRUISE)	400 (600)
CREW, PASSENGERS	1, 1 (Trike: 2 passengers or cargo)
COMFORT LEVEL	Basic Seating
CARGO	—
STRUCTURE	1
SHIPPING	0.5 tons (Trike: 0.75 tons)
COST	Cr4500 (Trike: Cr5250)



Armour

Forward	3 (11)
Port	3 (11)
Dorsal	3 (11)
Aft	3 (11)
Starboard	3 (11)
Ventral	3 (11)

EQUIPMENT

Control System (basic), Navigation System (basic), Transceiver (improved)	Autopilot (skill level)	—
	Communications (range)	500km
	Navigation (Navigation DM)	+1
	Sensors (Electronics (sensors) DM)	—
	Camouflage (Recon DM)	—
	Stealth (Electronics (sensors) DM)	—

DRACOFLAME

What started as a vanity project at a Naasirka lab on Tenalphi developed into a vanity biotech construct serving as a cavalry mount among the huscarles of certain noble families. The Dracoflame is a biotech version of a fire breathing dragon, its wings flapping at near the limits of technology to bring its flamer and monofilament claws into range of the enemy. An advanced multi-chromatic surface provides for camouflage in a variety of environments and bright colours for parades and fly-overs.

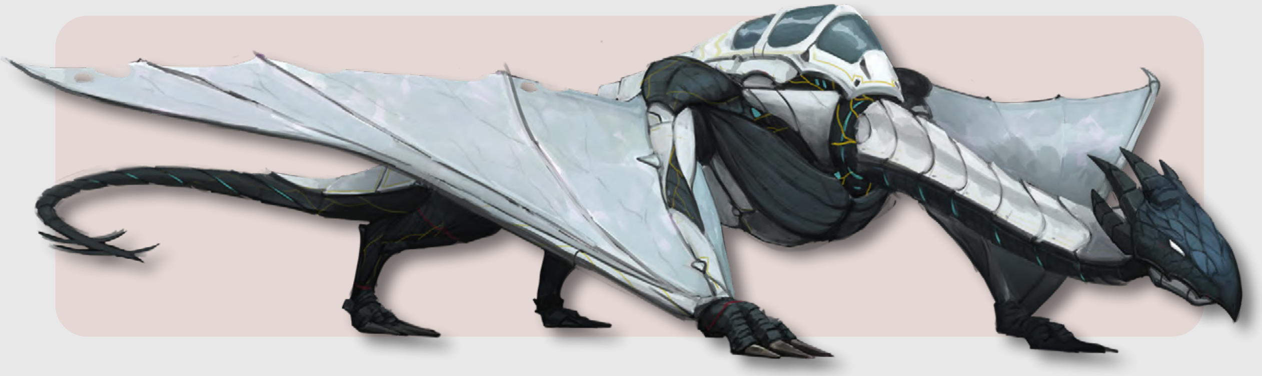
TYPE: Small Rotorcraft (3 Spaces, DM+0 to hit)

TL	14
SKILL	Flyer (ornithopter)
AGILITY	+7
SPEED (CRUISE)	Very Fast (Fast)
RANGE (CRUISE)	900 (1,350)
CREW, PASSENGERS	1, 1
COMFORT LEVEL	Basic Seating
CARGO	—
STRUCTURE	1 (heals every 24 hours)
SHIPPING	0.5625 tons
COST	MCr1

Armour

Forward	26 (40)	Aft	25 (39)
Port	26 (40)	Starboard	26 (40)
Dorsal	25 (39)	Ventral	26 (40)

FEATURES AND TRAITS: Agile, Biotech (Endothermic, Vertebrate), Fast, Folding Wings, Open Frame, Ornithopter, Responsive, Streamlined, VTOL



EQUIPMENT

Autopilot (advanced), Camouflage (advanced), Combat Vehicle Brain (advanced), Control System (enhanced), Gecko Grippers, Navigation System (improved), Sensor System (enhanced), Stealth (improved), Transceiver (advanced), Vehicle Brain Interface	Autopilot (skill level)	+3
	Communications (range)	500km
	Navigation (Navigation DM)	+3
	Sensors (Electronics (sensors) DM)	+2, 75km
	Camouflage (Recon DM)	-5,50m min range, multi-chromatic
	Stealth (Electronics (sensors) DM)	-3

Weapons	Range	Damage	Magazine	Cost	Traits	Fire Control
Hardpoint: Forward, Fire Breath	0.02	4D	30	—	Blast 3, Fire, Scope	+2
Hardpoint x2: Forward, Monofilament Claws (3 Space) x2	Melee	2D+4	—	—	AP 10	+0
Hardpoint: Port, Monofilament Claws (3 Space) x4	Melee	2D+4	—	—	AP 10	+0
Hardpoint: Starboard, Monofilament Claws (3 Space)	Melee	2D+4	—	—	AP 10	+0

EXPRESS FOOD TRUCK

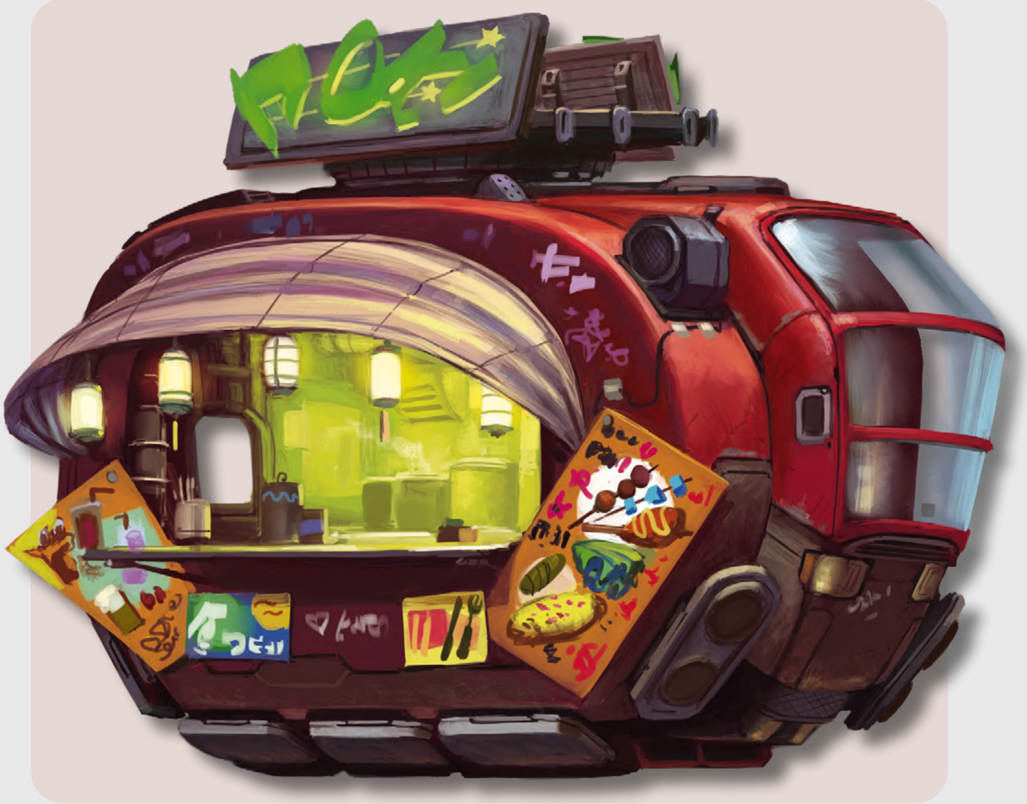
Meandering above work sites, residential towers and office parks, the express food truck is a common sight on many populous worlds, serving to the masses. It is equipped to handle the lunch-time crowd, either parking in a lot, hovering above the ground or near a balcony to serve a variety of spicy dishes.

TYPE: Heavy Grav Vehicle (20 Spaces, DM+2 to hit) Light Hull
FEATURES AND TRAITS: Slow, Unresponsive, VTOL

TL	12
SKILL	Flyer (grav)
AGILITY	+1
SPEED (CRUISE)	Medium (Slow)
RANGE (CRUISE)	2,250 (3,380)
CREW	4
COMFORT LEVEL	Basic Comfort
CARGO	1 ton
STRUCTURE	3
SHIPPING	10 tons
COST	Cr140000

Armour

Forward	6 (18)
Port	6 (18)
Dorsal	6 (18)
Aft	6 (18)
Starboard	6 (18)
Ventral	6 (18)



EQUIPMENT

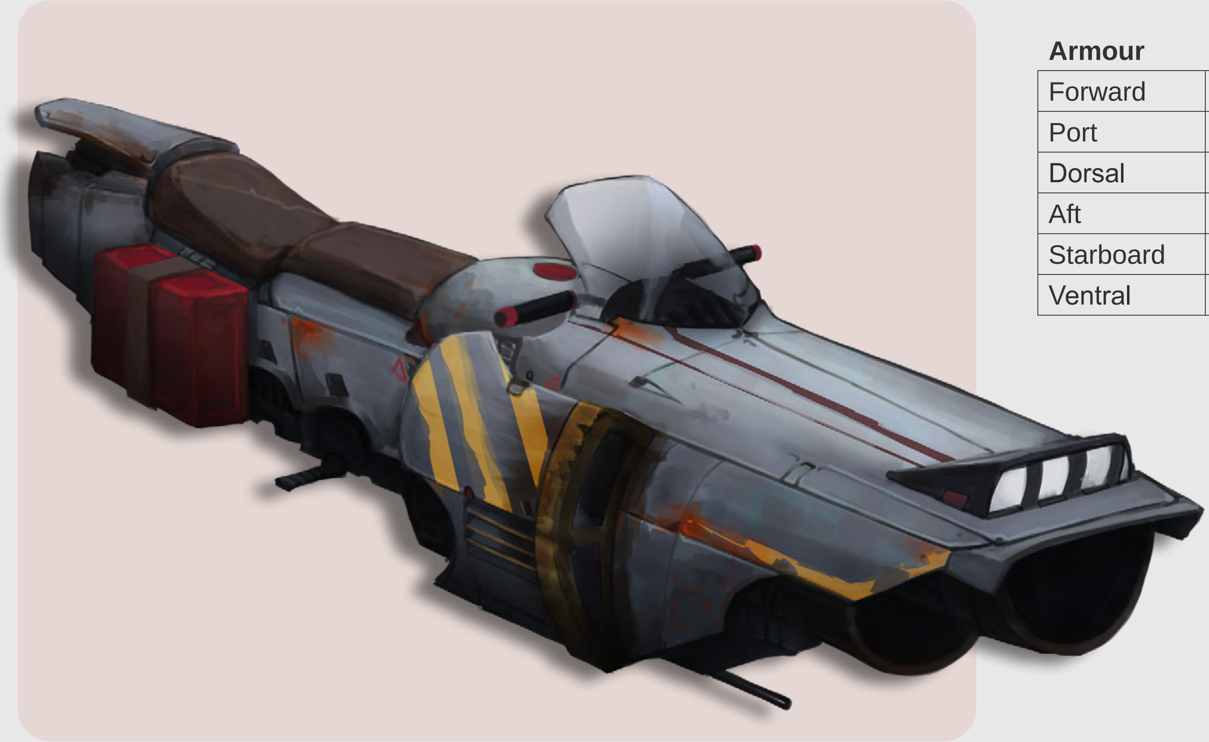
Autopilot (improved), Collision Protection (advanced) x20, Computer/1, Control System (improved), Fresher (half), Galley (full) x2, Navigation System (basic), Transceiver (advanced), Vehicle Parachute (enhanced)	Autopilot (skill level)	+1
	Communications (range)	50km
	Navigation (Navigation DM)	+1
	Sensors (Electronics (sensors) DM)	—
	Camouflage (Recon DM)	—
	Stealth (Electronics (sensors) DM)	—

G/BIKE

Much like its ground-based predecessors, the G/bike's speed and size make it a favourite with Travellers needing to make their own way across a strange planet. It is also the focus of many subcultures and gangs across Charted Space. This is a basic unit with an ejection seat and stock entertainment system, although added features can improve performance or styling at potentially much greater cost.

TYPE: Small Grav Vehicle (1 Space, DM+0 to hit)
FEATURES AND TRAITS: Open Frame, VTOL

TL	12
SKILL	Flyer (grav)
AGILITY	+3
SPEED (CRUISE)	Very Fast (Fast)
RANGE (CRUISE)	2,400 (3,600)
CREW	1
COMFORT LEVEL	Basic Seating
CARGO	—
STRUCTURE	1
SHIPPING	0.5 tons
COST	Cr46000



Armour

Forward	6 (18)
Port	6 (18)
Dorsal	6 (18)
Aft	6 (18)
Starboard	6 (18)
Ventral	6 (18)

EQUIPMENT

Autopilot (improved), Computer/1, Control System (improved), Ejection Seat, Entertainment System, Navigation System (improved), Sensor System (improved), Transceiver (advanced)	Autopilot (skill level)	+1
	Communications (range)	500km
	Navigation (Navigation DM)	+2
	Sensors (Electronics (sensors) DM)	+1, 5km
	Camouflage (Recon DM)	—
	Stealth (Electronics (sensors) DM)	—

G/CARRIER

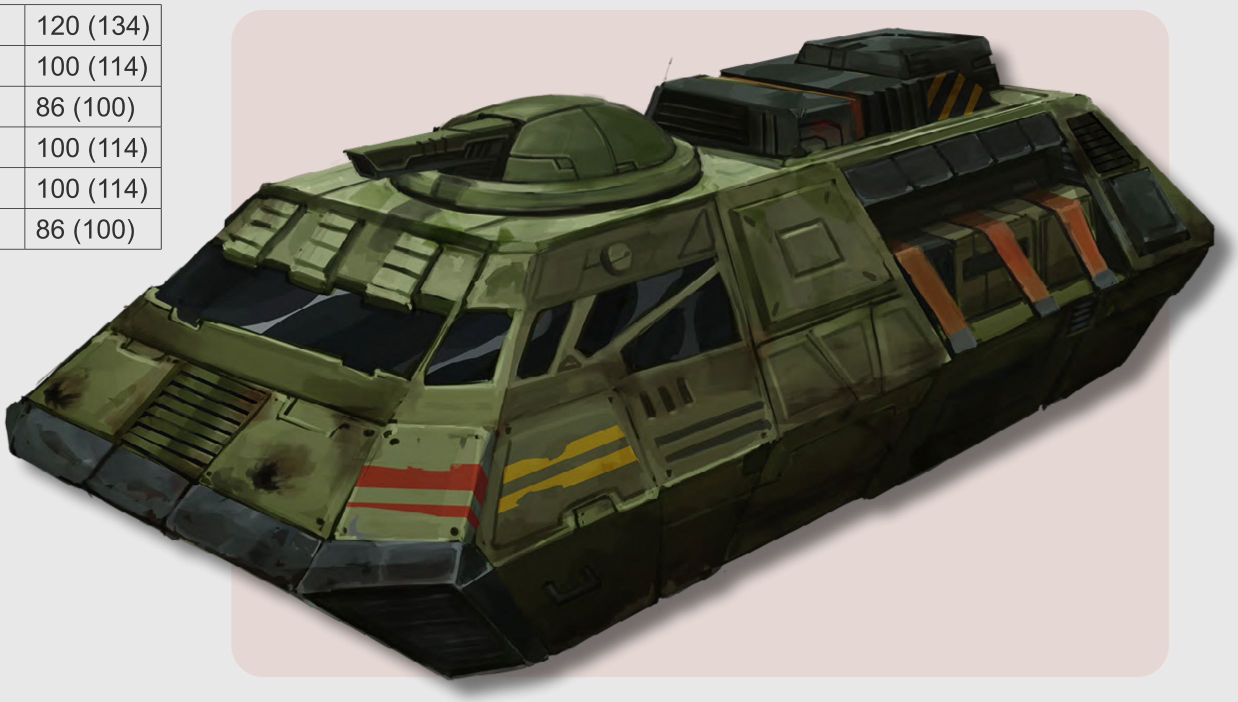
A G/carrier is effectively a flying armoured personnel carrier and a standard fighting vehicle of many military forces across Charted Space. The G/carrier can provide life support for its crew and eight troopers in hostile or vacuum environments, has the armour protection and firepower to fight in major engagements and the speed and range to arrive on the battlefield very quickly.

TYPE: Heavy Grav Vehicle (20 Spaces, DM+2 to hit) Reinforced Hull
FEATURES AND TRAITS: AFV, Fast, Streamlined, VTOL

TL	14
SKILL	Flyer (grav)
AGILITY	+3
SPEED (CRUISE)	Fast (High)
RANGE (CRUISE)	30,000 (45,000)
CREW, PASSENGERS	2, 8
COMFORT LEVEL	Basic Seating
CARGO	0.75 tons
STRUCTURE	7
SHIPPING	10 tons
COST	MCr7.75

Armour

Forward	120 (134)
Port	100 (114)
Dorsal	86 (100)
Aft	100 (114)
Starboard	100 (114)
Ventral	86 (100)



EQUIPMENT

Autopilot (advanced), Computer/2, Control System (enhanced), Docking Hatch, Fire Extinguishers, Fusion+ (improved, PP 6), Life Support (short term), Navigation System (advanced), Sensor System (advanced), Transceiver (advanced), Vacuum Environment Protection	Autopilot (skill level)	+3
	Communications (range)	5,000km, tightbeam, satellite uplink, encrypted
	Navigation (Navigation DM)	+4
	Sensors (Electronics (sensors) DM)	+3, 2,500km
	Camouflage (Recon DM)	-4,50m min range, multi-chromatic
	Stealth (Electronics (sensors) DM)	-4

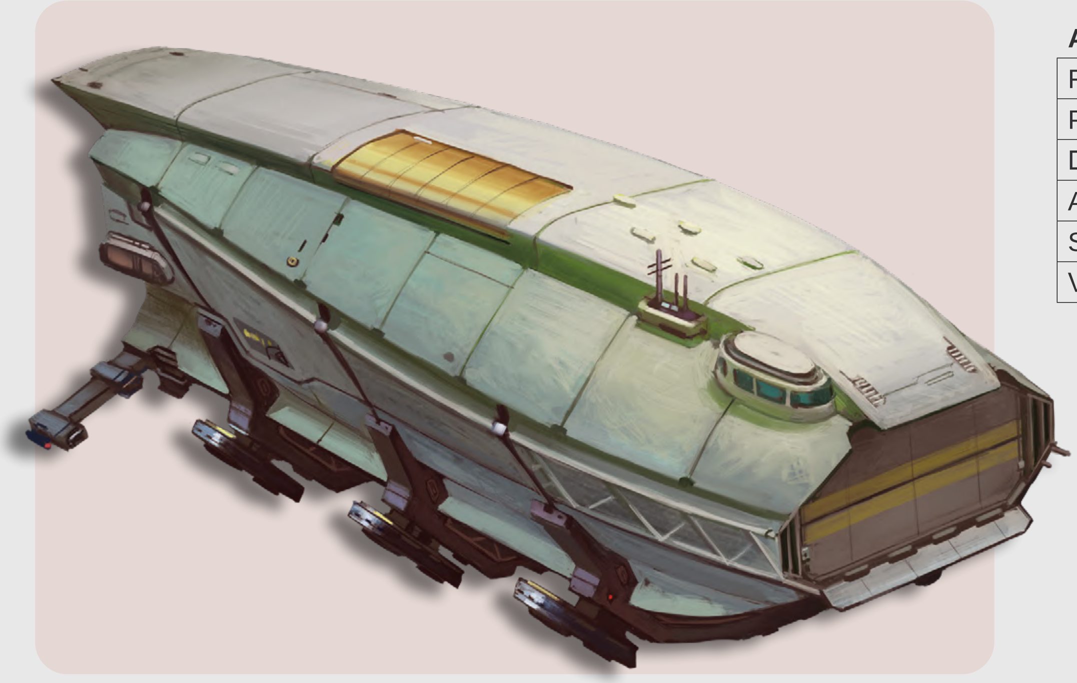
Weapons	Range	Damage	Magazine	Cost	Traits	Fire Control
Turret: Dorsal, Plasma Gun-B [F6]	5	3DD	—	—	AP 6, Blast 10, Scope	+4

G/HAULER

The G/Hauler is a cavernous beast that looks like a flying whale with a big gaping maw. Half its size is a massive hangar that can hold up to 200 shipping tons of vehicles or 400 tons of freight. More reminiscent of an airship than a grav ship, it is slow but can cover more than 15,000 kilometres, or more than 20,000 kilometres if its smaller cargo 'hump' is replaced with an auxiliary fuel tank – and all it needs for fuel is water. With a small forward cockpit and cabin area it accommodates up to four people but can function without a crew. It can even tow a lifter barge behind it, although that may make it even slower.

Type: Huge Grav Vehicle (1,600 Spaces, DM+5 to hit)
Light Hull
Features and Traits: Slow, Unresponsive, VTOL

TL	10
SKILL	Flyer (grav)
AGILITY	-1
SPEED (CRUISE)	Slow (Very Slow)
RANGE (CRUISE)	10,300 (15,500)
CREW, PASSENGERS	2, 2
COMFORT LEVEL	Basic Comfort
CARGO	38 tons, 200 Shipping tons hangar capacity (or 400 tons for cargo)
STRUCTURE	240
SHIPPING	800 tons
COST	MCr26.1



Armour

Forward	5 (15)
Port	5 (15)
Dorsal	5 (15)
Aft	5 (15)
Starboard	5 (15)
Ventral	5 (15)

EQUIPMENT

Autopilot (improved), Bunk x2, Collision Protection (improved) x7, Control System (basic), Crane (heavy), Docking Hatch, Drone Actuators, Drone Interface, Entertainment System x10, Fresher (half), Fusion+ (basic, PP 160), Hangar Bay x1,600, Navigation System (improved), Pressurised Hull, Sensor System (improved), Tow Hitch x1,600, Transceiver (enhanced)	Autopilot (skill level)	+1
	Communications (range)	5,000km, tightbeam, satellite uplink
	Navigation (Navigation DM)	+2
	Sensors (Electronics (sensors) DM)	+1, 50km
	Camouflage (Recon DM)	—
	Stealth (Electronics (sensors) DM)	—

G/RACER

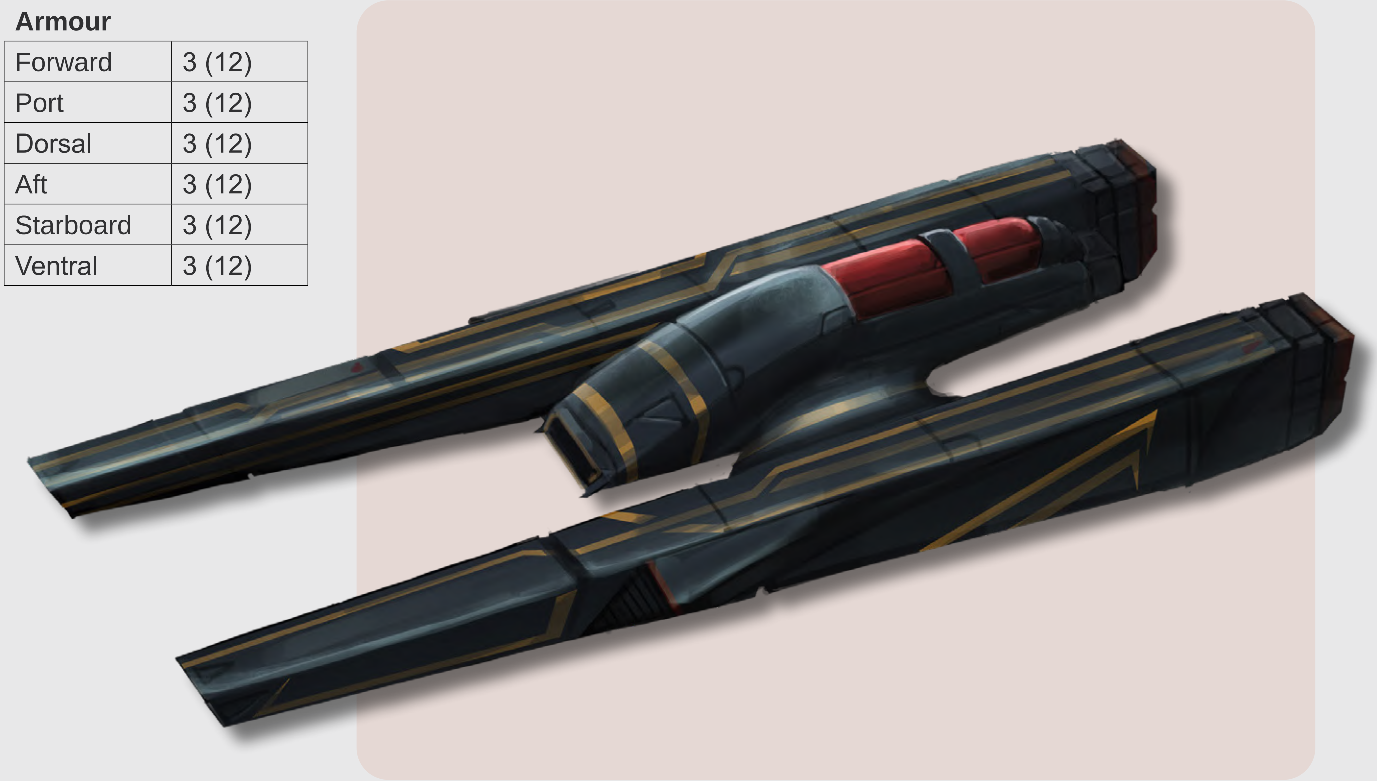
The natural extension of racing cars, G/racer sports can be found across Charted Space, through every conceivable terrain type and with varying casualty rates. These vehicles are extremely fast but notoriously fragile as every ounce of weight is squeezed out in the pursuit of massive speed. This model is a relatively less advanced racer and features room for a navigator, but higher tech models may substitute a Fusion+ engine for endurance courses or add vacuum protection and life support for racing in more extreme environments.

TYPE: Small Grav Vehicle (2 Spaces, DM+0 to hit)
FEATURES AND TRAITS: Fast, Responsive, Streamlined, VTOL

TL	9
SKILL	Flyer (grav)
AGILITY	+3
SPEED (CRUISE)	Subsonic (Very Fast)
RANGE (CRUISE)	1,880 (2,810)
CREW, PASSENGERS	1, 1
COMFORT LEVEL	Basic Seating
CARGO	—
STRUCTURE	1
SHIPPING	1 ton
COST	Cr360000

Armour

Forward	3 (12)
Port	3 (12)
Dorsal	3 (12)
Aft	3 (12)
Starboard	3 (12)
Ventral	3 (12)



EQUIPMENT

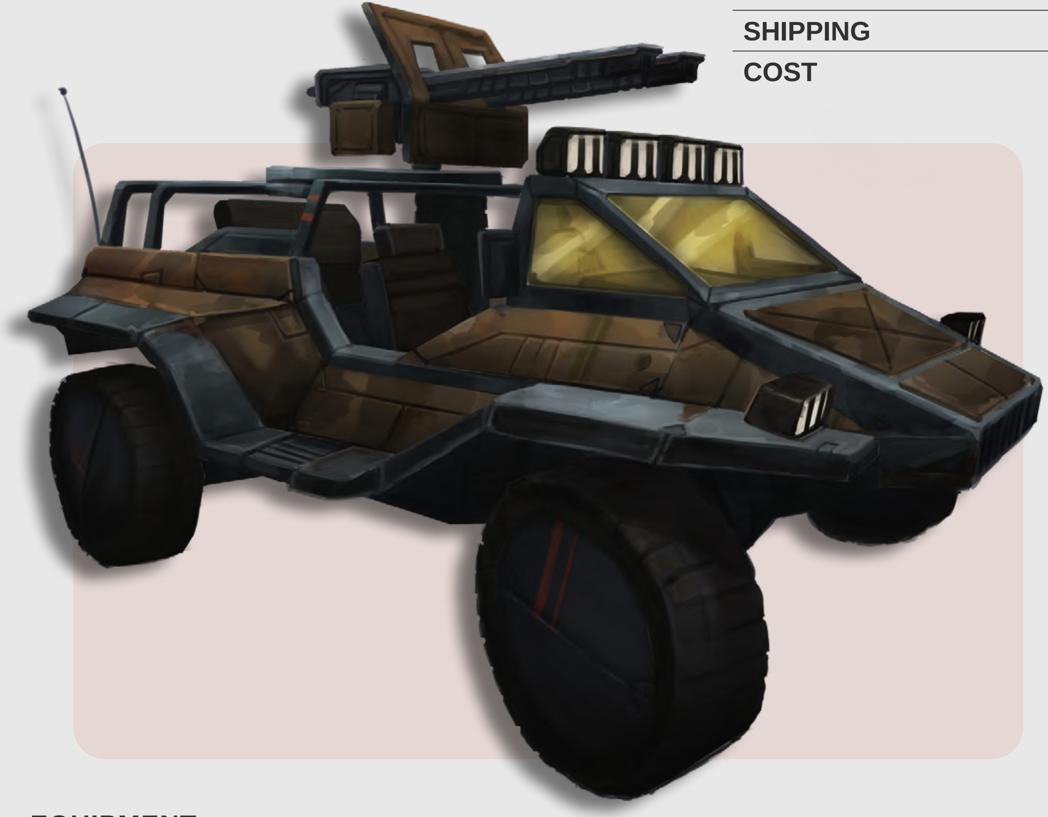
Autopilot (basic), Collision Protection (improved) x2, Computer/1, Control System (improved), Ejection Seat x2, Navigation System (basic), Pressurised Hull, Sensor System (improved), Transceiver (improved)	Autopilot (skill level)	+0
	Communications (range)	500km
	Navigation (Navigation DM)	+1
	Sensors (Electronics (sensors) DM)	+1, 5km
	Camouflage (Recon DM)	—
	Stealth (Electronics (sensors) DM)	—

GECKO ALL-TERRAIN ASSAULT VEHICLE

Designed to transport a fire team or VIP through a war zone, the Gecko can handle a wide variety of terrain at some speed and, despite being only semi-enclosed, its armour is sufficient to resist small arms fire of an equivalent Tech Level. It also sports a powerful punch, with twin-linked autocannon mounted on the roof.

TYPE: Light Ground Vehicle (9 Spaces, DM+1 to hit)
FEATURES AND TRAITS: ATV, Open-Topped

TL	7
SKILL	Drive (wheel)
AGILITY	+0
SPEED (CRUISE)	High (Medium)
RANGE (CRUISE)	500 (750)
CREW, PASSENGERS	2, 3
COMFORT LEVEL	Basic Seating
CARGO	—
STRUCTURE	2
SHIPPING	4.5 tons
COST	Cr50300



Armour

Forward	12 (19)
Port	12 (19)
Dorsal	—
Aft	12 (19)
Starboard	12 (19)
Ventral	7 (14)

EQUIPMENT

Camouflage (improved), Control System (basic), Transceiver (basic)	Autopilot (skill level)	—
	Communications (range)	500km
	Navigation (Navigation DM)	—
	Sensors (Electronics (sensors) DM)	—
	Camouflage (Recon DM)	-2, 200m min range, visual, IR
	Stealth (Electronics (sensors) DM)	—

Weapons	Range	Damage	Magazine	Cost	Traits	Fire Control
Pintle Mount: Forward, Autocannon (light) x2, gun shield +12	1	6D+6	500	Cr1000	Auto 3, Scope	+0

GRAV CHAIR

At its most basic, the grav chair is a small oval disk with one chair placed in the middle. The basic unit is an open-topped vehicle with an autopilot and basic controls displayed on a simplified command panel, sometimes entirely hidden to allow voice-only commands. While technically capable of achieving orbit, it requires some time to do so and the occupant would be entirely unprotected, but this is just the entry level model for an increasingly capable and luxurious grav chair line.

A more advanced version features an automatic convertible hardtop, improved collision protection and an ejection seat, adding Cr21000 to the cost. An all-environment version capable of supporting a passenger on an orbital outing also includes a life support seat option and vacuum protection for an additional Cr7000.

Another Cr6000 adds a more fuel-efficient engine, increasing Range to 4,500 (6,800) kilometres. A higher performing engine changes speed to Fast (High) and removes the Slow and Unresponsive traits but decreases Range to 3,000 (4,500) at another Cr21000.

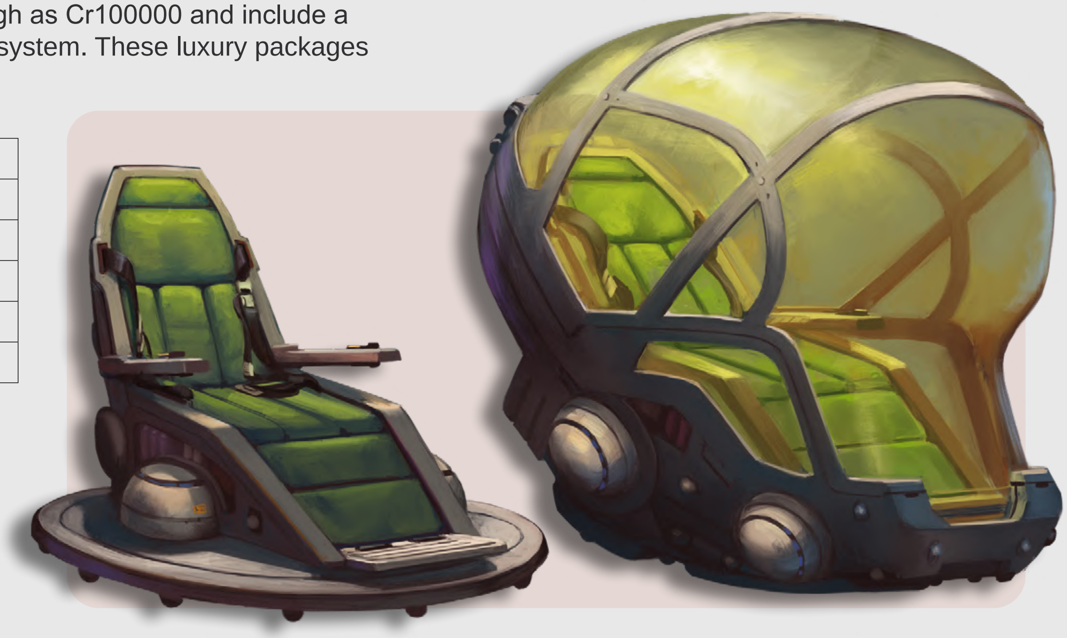
Finally, luxury interior/exterior space packages start at Cr7000 and range as high as Cr100000 and include a separate entertainment system. These luxury packages can run atop even a base model, providing an extremely showy but slow chair for a noble to sit atop, potentially awing a low tech populace with otherworldly power and wealth.

TL	11
SKILL	Flyer (grav)
AGILITY	+1
SPEED (CRUISE)	Slow (Very Slow)
RANGE (CRUISE)	2,250 (3,380)
PASSENGERS	1
COMFORT LEVEL	Basic Seating
CARGO	—
STRUCTURE	1
SHIPPING	0.5 tons
COST	Cr12600

TYPE: Small Grav Vehicle (1 Space, DM+0 to hit)
FEATURES AND TRAITS: Open-Topped, Slow, Unresponsive, VTOL

Armour

Forward	5 (16)
Port	5 (16)
Dorsal	—
Aft	5 (16)
Starboard	5 (16)
Ventral	5 (16)



EQUIPMENT

Autopilot (improved), Control System (basic), Navigation System (basic), Transceiver (enhanced)	Autopilot (skill level)	+1
	Communications (range)	500km
	Navigation (Navigation DM)	+1
	Sensors (Electronics (sensors) DM)	—
	Camouflage (Recon DM)	—
	Stealth (Electronics (sensors) DM)	—

GROUND CAR

This car is a standard TL7 automobile sold by the billions and is an oft-seen basic rental vehicle available on mid-industrial worlds. With seats for a driver and passenger in front and a bench seat in the back to carry two people, but capable of crowding at least one more adult between them, it has a generous enough space for luggage. The collision system is a standard requirement on many worlds and the entertainment system is of acceptable quality.

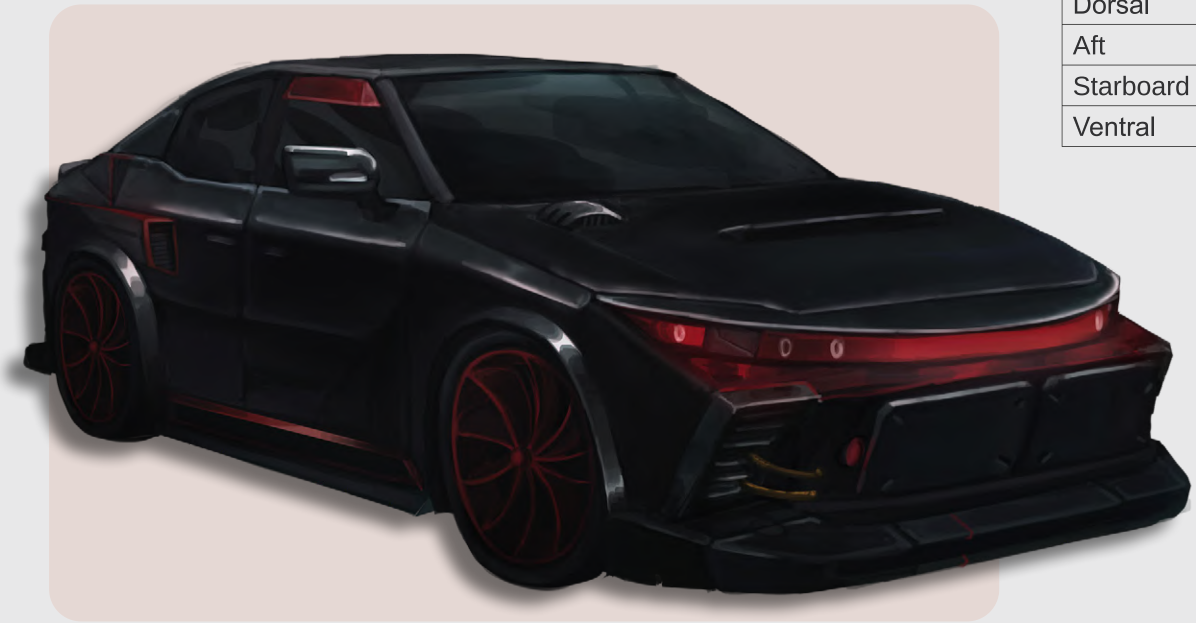
Available for under Cr5000, it is often rented out at as little as Cr20 per day or less with minimal deposit. Most rental companies do not bother with a tracking device or navigation system as it is cheaper to let a few cars 'disappear' than to add expensive equipment. After a few years rental service, these cars are sold used for as little as Cr2000 but almost certainly with at least one quirk.

TYPE: Light Ground Vehicle (6 Spaces, DM+1 to hit)
FEATURES AND TRAITS: None

TL	7
SKILL	Drive (wheel)
AGILITY	+0
SPEED (CRUISE)	Medium (Slow)
RANGE (CRUISE)	500 (750)
CREW, PASSENGERS	1, 3
COMFORT LEVEL	Basic Seating
CARGO	0.5 tons
STRUCTURE	2
SHIPPING	3 tons
COST	Cr4999

Armour

Forward	3 (10)
Port	3 (10)
Dorsal	3 (10)
Aft	3 (10)
Starboard	3 (10)
Ventral	3 (10)



EQUIPMENT

Collision Protection (basic) x4, Control System (basic), Entertainment System, Transceiver (improved)	Autopilot (skill level)	—
	Communications (range)	5km
	Navigation (Navigation DM)	—
	Sensors (Electronics (sensors) DM)	—
	Camouflage (Recon DM)	—
	Stealth (Electronics (sensors) DM)	—

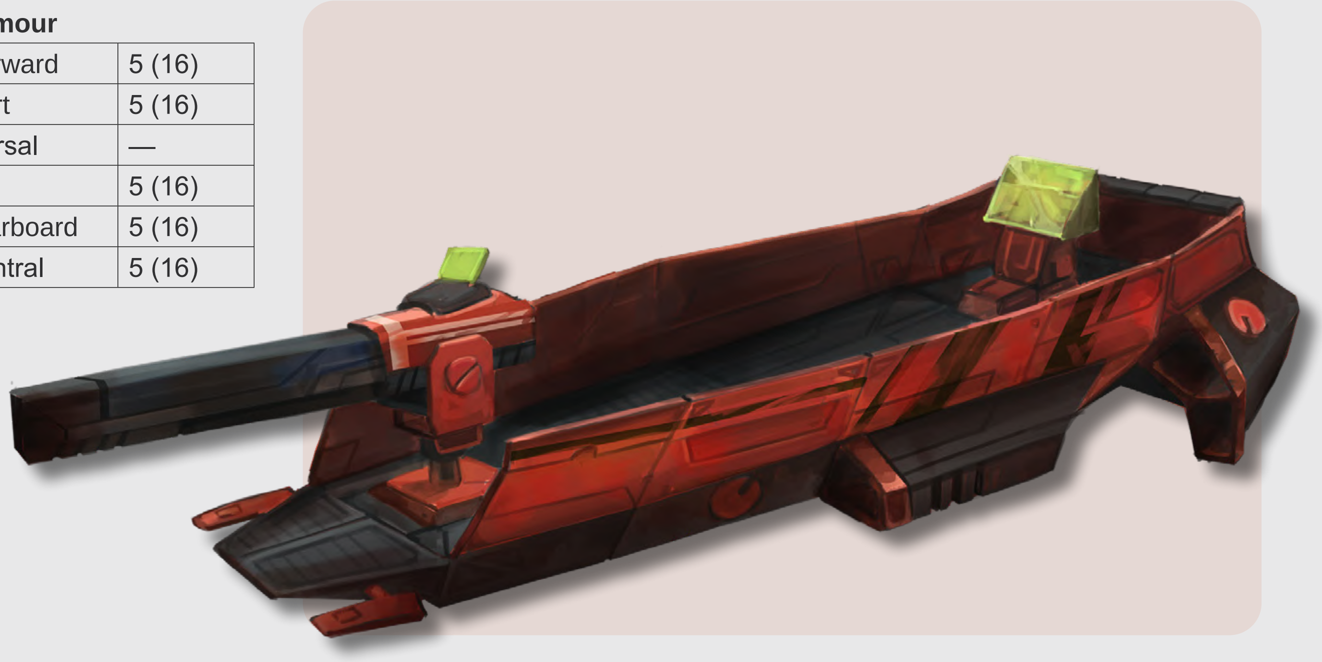
GUNSKIFF

Despite some models featuring extreme styling to conform to standards of fashion, the gunskiff is essentially a sluggish open-topped grav platform mounting a single heavy weapon. It is an extremely cheap and effective way to bring a heavy weapon to bear over a wide area but its light armour and open nature often means it is best employed against relatively primitive enemies. The flatbed nature of the gunskiff means that if it does not carry passengers, it can easily accommodate up to three tons of cargo instead.

TYPE: Heavy Grav Vehicle (20 Spaces, DM+2 to hit)
Light Hull
FEATURES AND TRAITS: Open-Topped, Slow, Unresponsive, VTOL

TL	11
SKILL	Flyer (grav)
AGILITY	+0
SPEED (CRUISE)	Slow (Very Slow)
RANGE (CRUISE)	984 (1,480)
CREW, PASSENGERS	2, 12
COMFORT LEVEL	Basic Seating
CARGO	—
STRUCTURE	3
SHIPPING	10 tons
COST	Cr278000

Armour	
Forward	5 (16)
Port	5 (16)
Dorsal	—
Aft	5 (16)
Starboard	5 (16)
Ventral	5 (16)



EQUIPMENT

Autopilot (improved), Control System (basic), Smoke Discharger, Transceiver (enhanced)	Autopilot (skill level)	+1
	Communications (range)	500km
	Navigation (Navigation DM)	—
	Sensors (Electronics (sensors) DM)	—
	Camouflage (Recon DM)	—
	Stealth (Electronics (sensors) DM)	—

Weapons	Range	Damage	Magazine	Cost	Traits	Fire Control
Fixed Mount: Forward, Laser Cannon (heavy)	10	1DD	—	—	AP 8, Scope	+1

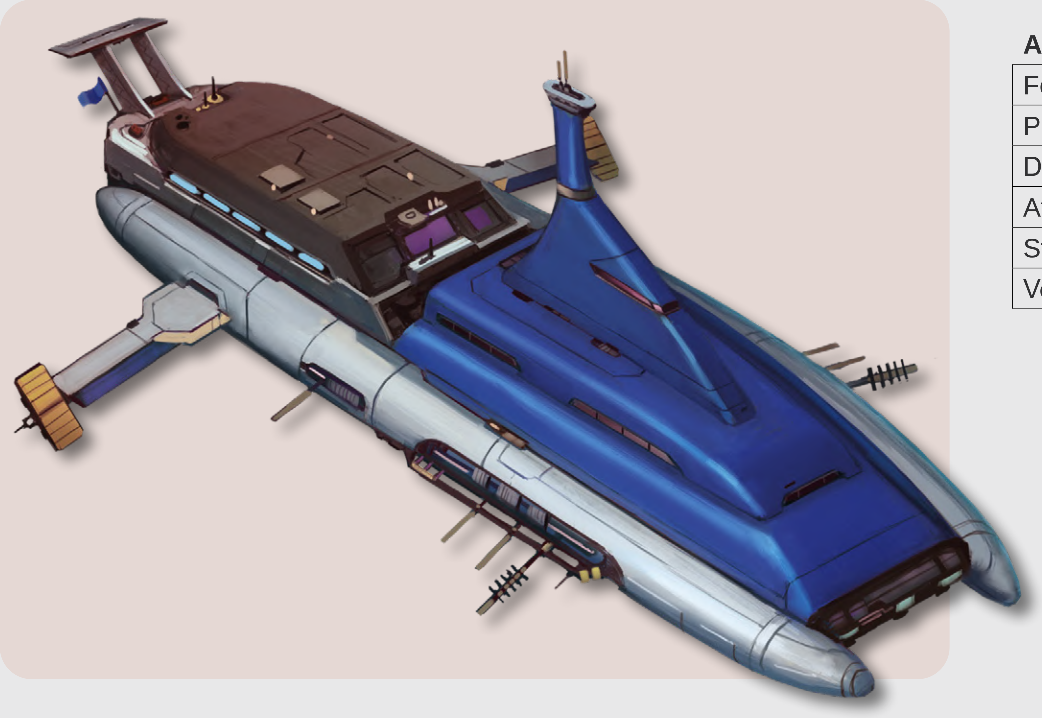
HORIZON HOVER FERRY

Designed for operation in coast, island and lake regions but also usable on flat plains and over icefields, the Horizon hover ferry is designed to carry approximately 100 car-sized vehicles and up to 1,000 passengers. Most ferry runs are less than 100 kilometres and take two or three hours at most to complete, so there are no long-term accommodations on board.

The Horizon has occasionally been put into service as a short-range military troop, vehicle and/or supply vessel but it is thin-skinned with no weaponry. When used in military roles, guns are often mounted on the upper deck for defensive purposes.

TYPE: Massive Hovercraft (5,000 Spaces, DM+6 to hit) Light Hull
FEATURES AND TRAITS: Unresponsive

TL	7
SKILL	Drive (hovercraft)
AGILITY	-3
SPEED (CRUISE)	Slow (Very Slow)
RANGE (CRUISE)	200 (300)
CREW, PASSENGERS	20, 1000
COMFORT LEVEL	Long Duration Seating
CARGO	125 tons
STRUCTURE	188
SHIPPING	2,500 tons
COST	MCr69.6



Armour

Forward	3 (10)
Port	3 (10)
Dorsal	3 (10)
Aft	3 (10)
Starboard	3 (10)
Ventral	3 (10)

EQUIPMENT

Autopilot (basic), Common Space x200, Control System (basic), Fire Extinguishers, Fresher (half) x24, Galley (full) x11, Hangar Bay x3,200, Navigation System (basic), Sensor System (basic), Sensor System (basic, underwater), Transceiver (improved)	Autopilot (skill level)	+0
	Communications (range)	500km, satellite uplink
	Navigation (Navigation DM)	+1
	Sensors (Electronics (sensors) DM)	+0, 1km; Underwater: +0, 1km
	Camouflage (Recon DM)	—
	Stealth (Electronics (sensors) DM)	—

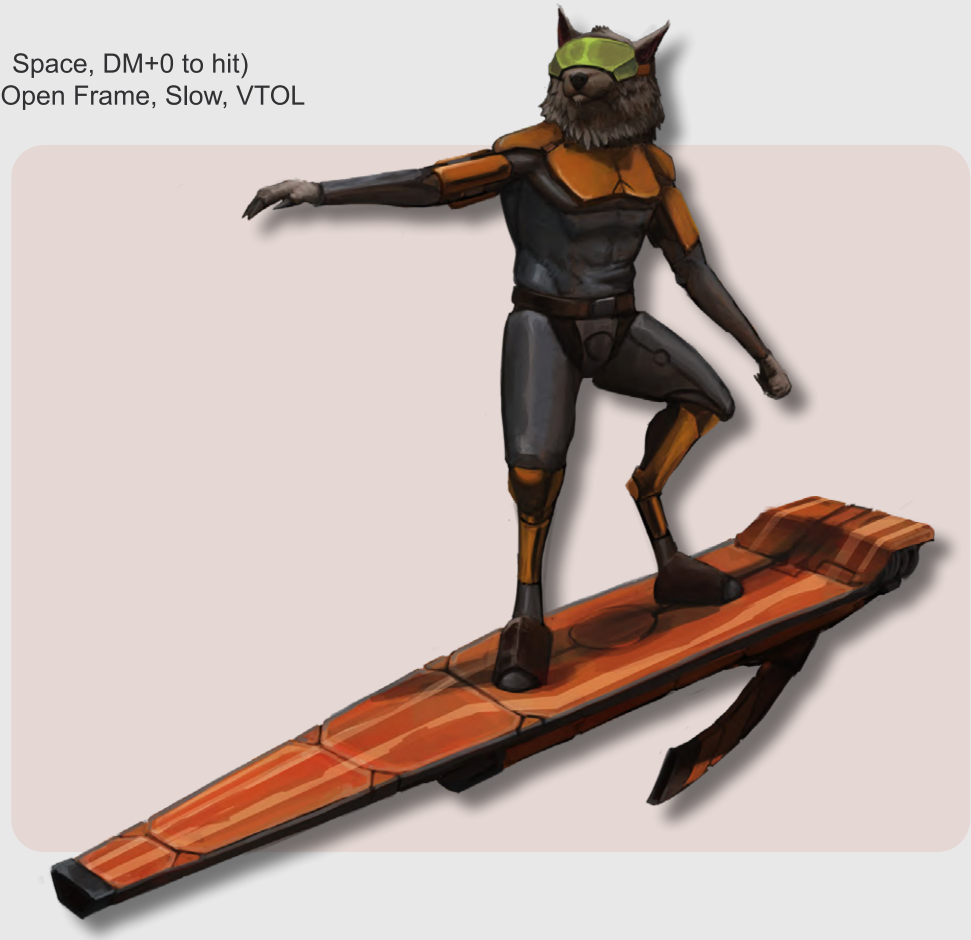
HOVERBOARD

The hoverboard is the simplest and cheapest grav vehicle available, basically a platform that allows the operator to stand upon and control it in a rudimentary and often hazardous way. In theory, it can lift its occupant out of the atmosphere but in practice it operates at much lower altitudes. Hoverboards are often banned or require collision protection, parachutes,or other protective systems that render them unpopular.

The base model is Cr4500 and limited to Very Slow speeds. Increasing speed costs more with models available for Slow (Cr7000), Medium (Cr10500), High (Cr13500) and Fast (Cr21000). Safety equipment costs extra.

TYPE: Small Grav Vehicle (1 Space, DM+0 to hit)
FEATURES AND TRAITS: Open Frame, Slow, VTOL

TL	8
SKILL	Flyer (grav)
AGILITY	+2
SPEED (CRUISE)	Very Slow (Idle)
RANGE (CRUISE)	1,200 (1,800)
CREW	1
COMFORT LEVEL	Basic Seating
CARGO	—
STRUCTURE	1
SHIPPING	0.25 tons
COST	Cr4500



Armour

Forward	3 (11)
Port	3 (11)
Dorsal	3 (11)
Aft	3 (11)
Starboard	3 (11)
Ventral	3 (11)

EQUIPMENT

Control System (basic)	Autopilot (skill level)	—
	Communications (range)	—
	Navigation (Navigation DM)	—
	Sensors (Electronics (sensors) DM)	—
	Camouflage (Recon DM)	—
	Stealth (Electronics (sensors) DM)	—

HYPER MAGTUBE CAR

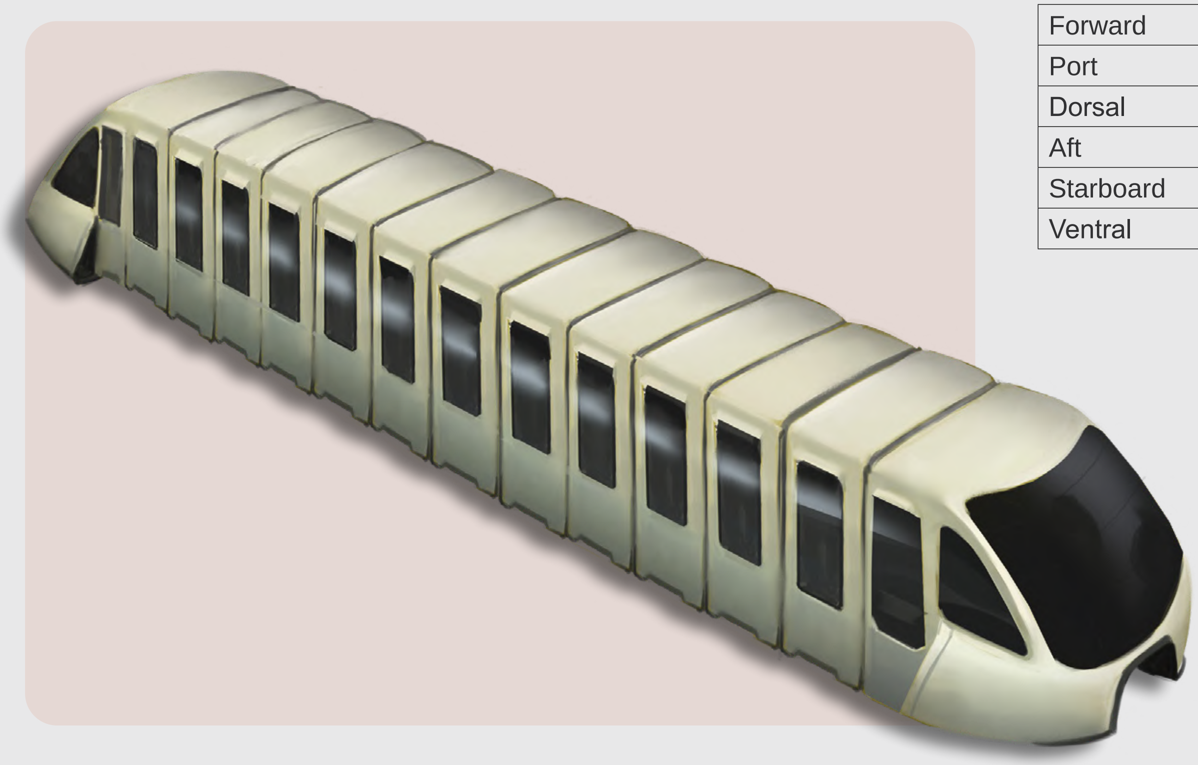
Running on a network of maglev-tracked vacuum tunnels spanning a continent, the Hyper MagTube Car is light rail at its fastest. Averaging 1,000 kilometres per hour, this rail car, individually or joined into a short commuter train, is focussed on short runs, with freshers but no food service. The car is powered by the maglev track, with only minimal battery backup. For longer routes, a service car with full-service galleys and table seating can be added, which services also contains emergency power equipment, vacc suits and rescue balls to allow for evacuation in cases of accidents in the evacuated tube

TYPE: Heavy Ground Vehicle (40 Spaces, DM+2 to hit)
FEATURES AND TRAITS: Rail Rider: Rail (enhanced): Maglev Vacc Tube

TL	8
SKILL	Drive (wheel)
AGILITY	-3
SPEED (CRUISE)	Supersonic (Subsonic)
RANGE (CRUISE)	n/a
CREW, PASSENGERS	1, 40
COMFORT LEVEL	Long Duration Seating
CARGO	0.5 tons
STRUCTURE	8
SHIPPING	20 tons
COST	Cr256000

Armour

Forward	3 (11)
Port	3 (11)
Dorsal	3 (11)
Aft	3 (11)
Starboard	3 (11)
Ventral	3 (11)



EQUIPMENT

Air Lock x2, Autopilot (improved), Collision Protection (basic) x40, Computer/0, Control System (basic), Entertainment System x82, Fire Extinguishers, Fresher (half) x4, Grid Power, Life Support (short term) x60, Sensor System (basic), Transceiver (improved), Vacuum Environment Protection, Vestibule Coupler x2	Autopilot (skill level)	+1
	Communications (range)	50km
	Navigation (Navigation DM)	—
	Sensors (Electronics (sensors) DM)	+0, 100km
	Camouflage (Recon DM)	—
	Stealth (Electronics (sensors) DM)	—

LIGHT CARGO LIFTER

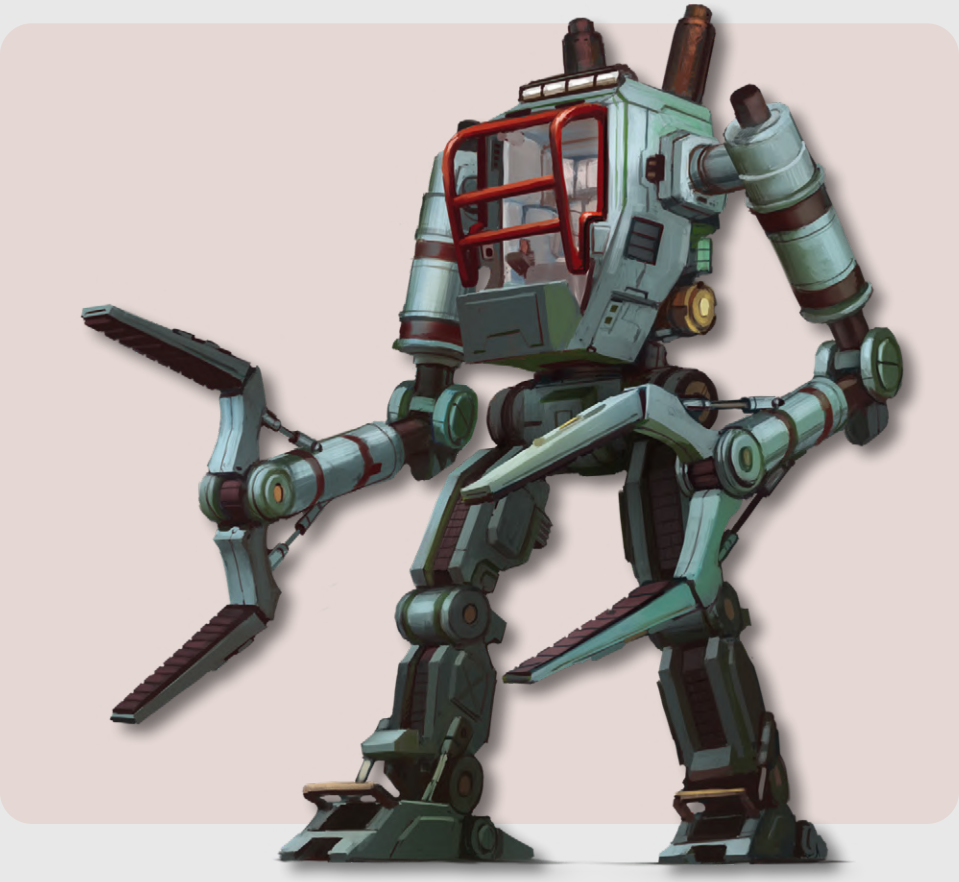
A common sight around starports and loading bays, the cargo lifter stands almost three metres high and is equipped with two small cranes with gripping attachments. While hardly as dexterous as manipulator arms, the cranes allow an operator to grip containers and other heavy objects quickly and efficiently. Combined, the two crane arms can move objects up to 1,700 kilograms. A sealed version, which includes vacuum protection and a life support seat, can be purchased for an extra Cr20000 to allow operation on hostile worlds but moves at a slower rate.

TYPE: Small Walker (3 Spaces, DM+0 to hit)
FEATURES AND TRAITS: Open Frame

TL	8
SKILL	Drive (walker)
AGILITY	+1
SPEED (CRUISE)	Slow (Very Slow)
RANGE (CRUISE)	120 (180)
CREW	1
COMFORT LEVEL	Basic Seating
CARGO	—
STRUCTURE	1
SHIPPING	0.75 tons
COST	Cr23100

Armour

Forward	3 (11)
Port	3 (11)
Dorsal	3 (11)
Aft	3 (11)
Starboard	3 (11)
Ventral	3 (11)



EQUIPMENT

Computer/0, Control System (basic), Crane (light) x2, Transceiver (improved)	Autopilot (skill level)	—
	Communications (range)	5km
	Navigation (Navigation DM)	—
	Sensors (Electronics (sensors) DM)	—
	Camouflage (Recon DM)	—
	Stealth (Electronics (sensors) DM)	—

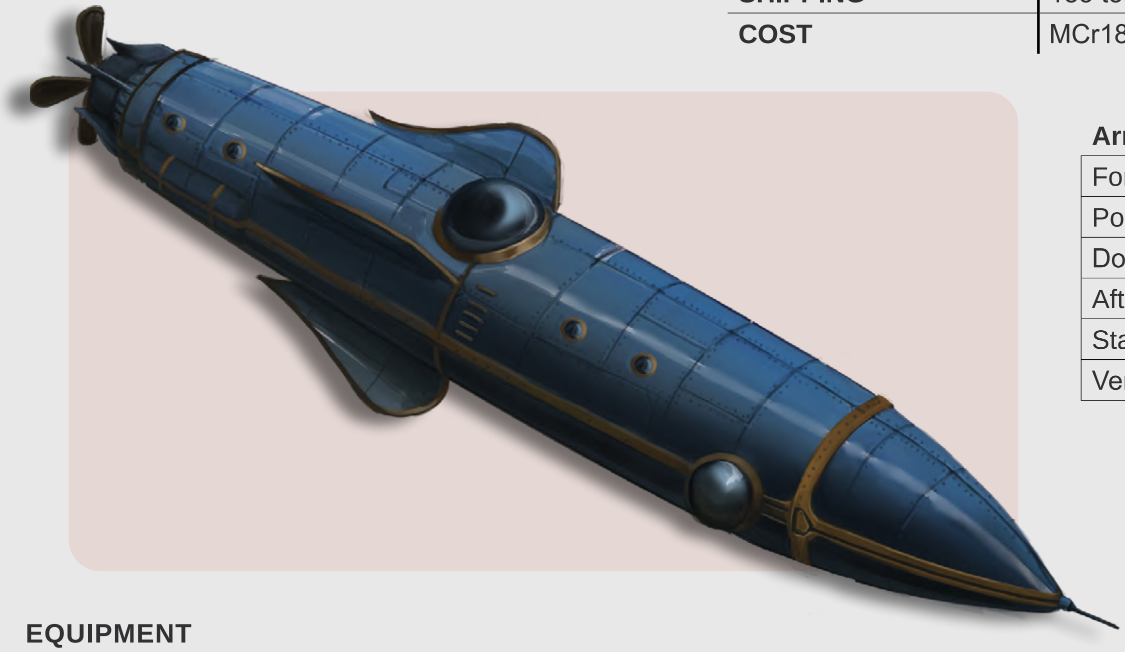
NAUTILUS

The creation of a man variously described as a visionary, a megalomaniac and a criminal, Nautilus can only be described as 'a masterpiece containing masterpieces'. Assembled in utmost secrecy on a deserted volcanic island from parts ordered from around the world, Nautilus, with its wholly electric engines powered by resources extracted from the seabed itself, represents the very forefront of TL4 technology.

Its sumptuous interior contains a wealth of both natural and crafted masterpieces, the likeness of which can be found in no museum, and the vessel's captain lives in comfort befitting a Maharajah.
Its 20-strong crew has simpler but comfortable accommodations and are fiercely loyal to their captain. Nautilus' beauty belies its deadly nature – armed with a metal-tipped ram, woe betide those tyrants at sea who would seek to oppress the weak.

TYPE: Huge Submersible (370 Spaces, DM+4 to hit)
Safe Depth 2,000m
FEATURES AND TRAITS: Unresponsive

TL	4
SKILL	Seafarer (submarine)
AGILITY	-4
SPEED (CRUISE)	Very Slow (Idle)
RANGE (CRUISE)	100 (150)
CREW, PASSENGERS	21, 3
COMFORT LEVEL	Varies
CARGO	6.25 tons; 5 Shipping tons docking capacity (or 5.50 tons for cargo)
STRUCTURE	111
SHIPPING	185 tons
COST	MCr1850



Armour

Forward	15 (19)
Port	15 (19)
Dorsal	15 (19)
Aft	15 (19)
Starboard	15 (19)
Ventral	15 (19)

EQUIPMENT

Air Lock (early prototype), Armoury x3, Brig (small), Common Space x66, Control System (basic), Fresher (half) x2, Galley (full), Library (improved), Life Support (short term) x24, Luxury Interior Space (basic) x48, Ram (metal tipped), Sleeping Berth x20, Stateroom (basic), Stateroom (improved) x2	Autopilot (skill level)	—
	Communications (range)	—
	Navigation (Navigation DM)	—
	Sensors (Electronics (sensors) DM)	—
	Camouflage (Recon DM)	—
	Stealth (Electronics (sensors) DM)	—

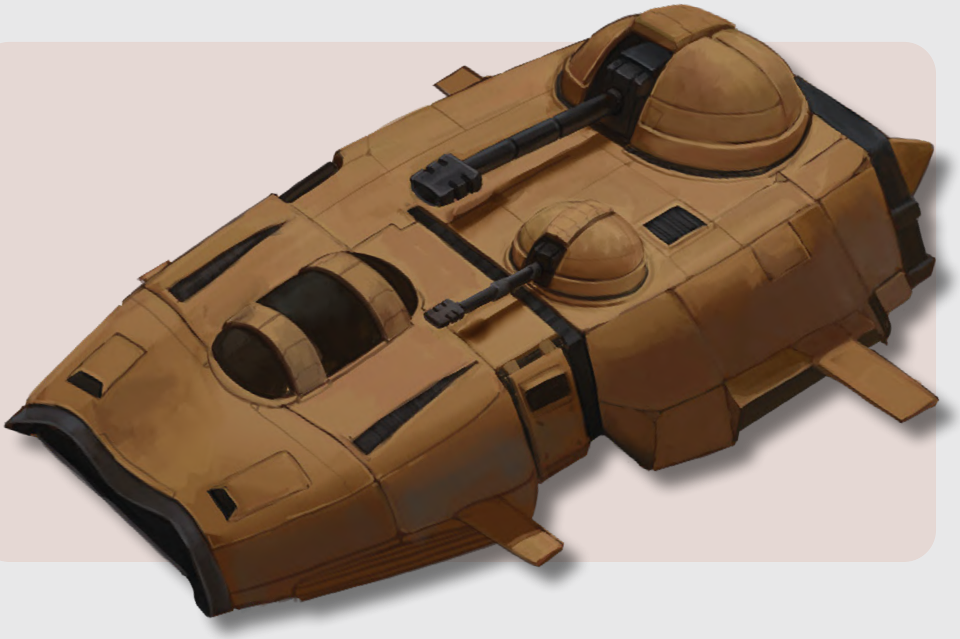
Weapons	Range	Damage	Magazine	Cost	Traits	Fire Control
Ram (metal tipped)	Melee	11D	—	—	AP 11	—

PALADIN LASER GRAV TANK

One of the first grav tanks to bring heavy laser fire backed by a fusion power plant to the battlefield, the Paladin is a fearsome foe, especially against more primitive forces. Used well, it can hold its own against stronger forces too. Its imposing weaponry comes with equally imposing size and it is an expensive weapon to move between worlds. However, the Paladin can be instrumental at shattering opposing armour and devastating to both air and ground forces within its considerable range.

TYPE: Heavy Grav Vehicle (68 Spaces, DM+2 to hit) Reinforced Hull
FEATURES AND TRAITS: AFV, Agile, Fast, Streamlined, VTOL

TL	9
SKILL	Flyer (grav)
AGILITY	+3
SPEED (CRUISE)	High (Medium)
RANGE (CRUISE)	26 years
CREW	3
COMFORT LEVEL	Basic Seating
CARGO	—
STRUCTURE	23
SHIPPING	34 tons
COST	MCr19.1



Armour

Forward	110 (119)
Port	79 (88)
Dorsal	50 (59)
Aft	50 (59)
Starboard	79 (88)
Ventral	50 (59)

EQUIPMENT

Autopilot (basic), Camouflage (improved), Computer/1, Control System (improved), ECM (improved, DM-1, 50km), Fire Extinguishers, Fusion (basic, PP 10), Hostile Environment Protection, Navigation System (improved), Pressurised Hull, Prismatic Aerosol Discharger, Radiation Protection, Reactive Armour (improved), Sensor System (improved), Transceiver (improved)	Autopilot (skill level)	+0
	Communications (range)	500km, tightbeam, satellite uplink, encrypted
	Navigation (Navigation DM)	+2
	Sensors (Electronics (sensors) DM)	+2, 50km, high fidelity, hardened, sensor mast
	Camouflage (Recon DM)	-2,200m min range, visual, IR
	Stealth (Electronics (sensors) DM)	—

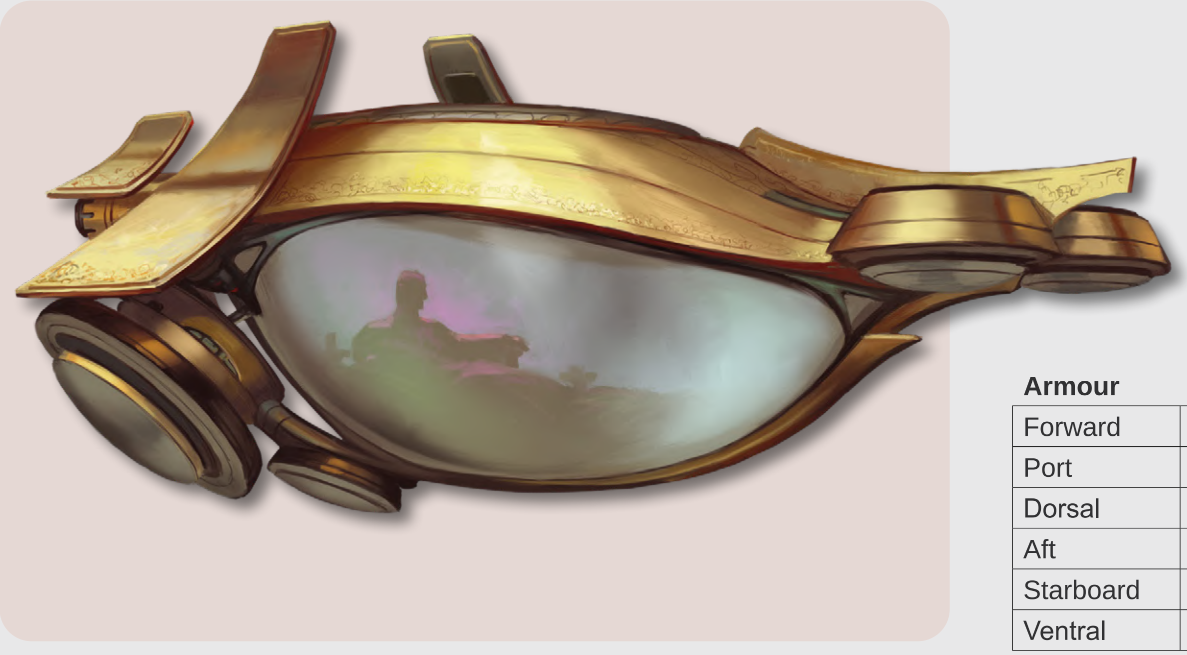
Weapons	Range	Damage	Magazine	Cost	Traits	Fire Control
Turret: Forward, Pulse Laser Gun (heavy) [F6]	20	3DD	—	—	AP 6, Scope	+2
Turret: Rotary Autocannon	1	6D	500	Cr1000	Auto 5, Scope	+2
Pintle Mount: VRF Machinegun	0.5	4D	1,000	Cr1250	Auto 6, Scope	+1

PALANQUIN

The Palanquin is a flying box, sumptuously decorated, heavily armoured and extremely comfortable. It is designed to carry one very important person in comfort and security across hostile environments. Whether that hostility is from the world's exterior conditions or from its political climate is irrelevant. In either case, it will protect its occupant as much as necessary, potentially turning into a 'glass' box to allow all to see and admire the esteemed passenger, or opaque, with patterns of gems and metals, ornate landscapes or whatever image the owner wants to project. Although capable of flying high and fast, it often 'strolls' at nearly ground level and walking speed to allow itself and its occupant to be noticed.

TYPE: Light Grav Vehicle (4 Spaces, DM+1 to hit)
Reinforced Hull
FEATURES AND TRAITS: VTOL

TL	12
SKILL	Flyer (grav)
AGILITY	+4
SPEED (CRUISE)	Fast (High)
RANGE (CRUISE)	3,000 (4,500)
PASSENGERS	1
COMFORT LEVEL	Excellent Comfort
CARGO	—
STRUCTURE	1
SHIPPING	2 tons
COST	Cr928000



Armour

Forward	43 (55)
Port	43 (55)
Dorsal	42 (54)
Aft	43 (55)
Starboard	43 (55)
Ventral	42 (54)

EQUIPMENT

Autopilot (advanced), Camouflage (advanced), Collision Protection (advanced) x2, Computer/3, Control System (advanced), Docking Hatch, Ejection Seat, Entertainment System x200, Life Support Seat, Luxury Exterior (SOC 13+), Luxury Interior Space (advanced) x2, Navigation System (enhanced), Self-Sealing Hull, Sensor System (improved), Stealth (enhanced), Transceiver (advanced), Vacuum Environment Protection	Autopilot (skill level)	+3
	Communications (range)	500km, tightbeam, encrypted
	Navigation (Navigation DM)	+3
	Sensors (Electronics (sensors) DM)	+1, 50km, hardened
	Camouflage (Recon DM)	-4,50m min range, multi-chromatic
	Stealth (Electronics (sensors) DM)	-3

PERSONAL LAND YACHT

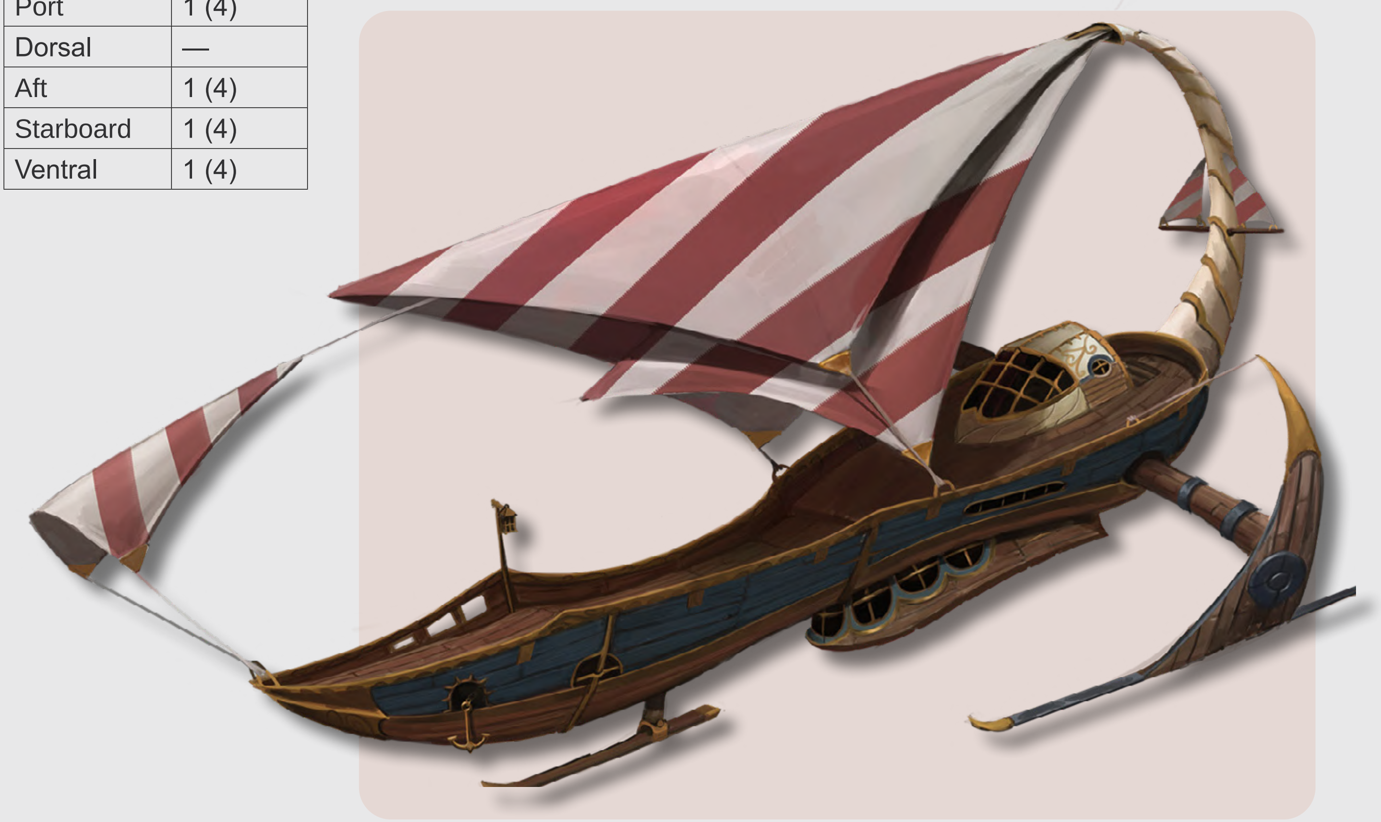
This wind-powered vehicle is used on worlds with typically flat terrain and reliable winds. It is capable of traversing great distances with favourable winds but while a passenger can be carried, it is very cramped.

TYPE: Small Ground Vehicle (1 Space, DM+0 to hit)
FEATURES AND TRAITS: Open-Topped, Streamlined

TL	3
SKILL	Drive (wheel)
AGILITY	+1
SPEED (CRUISE)	Very Slow (Idle)
RANGE (CRUISE)	n/a
CREW, PASSENGERS	1, 1
COMFORT LEVEL	Uncomfortable Seating
CARGO	—
STRUCTURE	1
SHIPPING	1 ton
COST	Cr1680

Armour

Forward	1 (4)
Port	1 (4)
Dorsal	—
Aft	1 (4)
Starboard	1 (4)
Ventral	1 (4)



EQUIPMENT

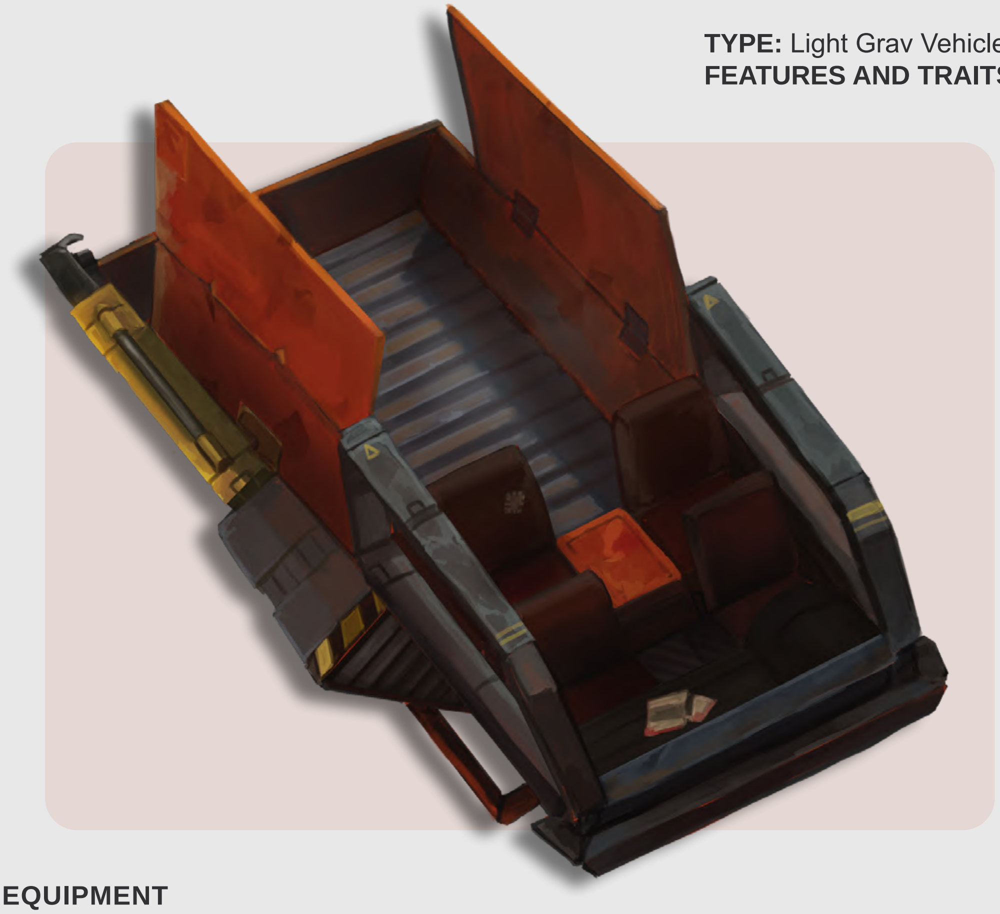
Control System (basic), Wind Powered	Autopilot (skill level)	—
	Communications (range)	—
	Navigation (Navigation DM)	—
	Sensors (Electronics (sensors) DM)	—
	Camouflage (Recon DM)	—
	Stealth (Electronics (sensors) DM)	—

PROSPECTING BUGGY

The prospecting buggy is a simple, venerable tool of miners across the Third Imperium. Standard practice is to transport three miners to a work site, fold away the passenger seats (increasing cargo space to 1.5 tons), then use the buggy to ferry ore between the mining site and a base camp (typically a Type-J seeker or ore-processing facility). The buggy can attach to the exterior of an airlock hatch for easy access during operations and has a winch and tow hitch to pull an external load. Its crane is equipped with short-range gravitic plates and a gripping claw to scoop loose ore quickly, with sufficient articulation to deposit it into the buggy. This version is not vacuum-sealed, instead relying on crew to wear appropriate environmental protection.

TL	12
SKILL	Flyer (grav)
AGILITY	+1
SPEED (CRUISE)	Fast (High)
RANGE (CRUISE)	3,000 (4,500)
CREW, PASSENGERS	1, 3
COMFORT LEVEL	Basic Seating
CARGO	0.75 tons
STRUCTURE	2
SHIPPING	4 tons
COST	Cr270000

TYPE: Light Grav Vehicle (8 Spaces, DM+1 to hit)
FEATURES AND TRAITS: Open-Topped, VTOL



Armour

Forward	6 (18)
Port	6 (18)
Dorsal	—
Aft	6 (18)
Starboard	6 (18)
Ventral	6 (18)

EQUIPMENT

Autopilot (basic), Computer/3, Control System (basic), Crane (light), Docking Hatch, Navigation System (improved), Sensor System (enhanced), Tow Hitch x8, Transceiver (superior), Winch	Autopilot (skill level)	+0
	Communications (range)	5,000km
	Navigation (Navigation DM)	+2
	Sensors (Electronics (sensors) DM)	+2, 150km
	Camouflage (Recon DM)	—
	Stealth (Electronics (sensors) DM)	—

PUBLIC SAFETY CRUISER

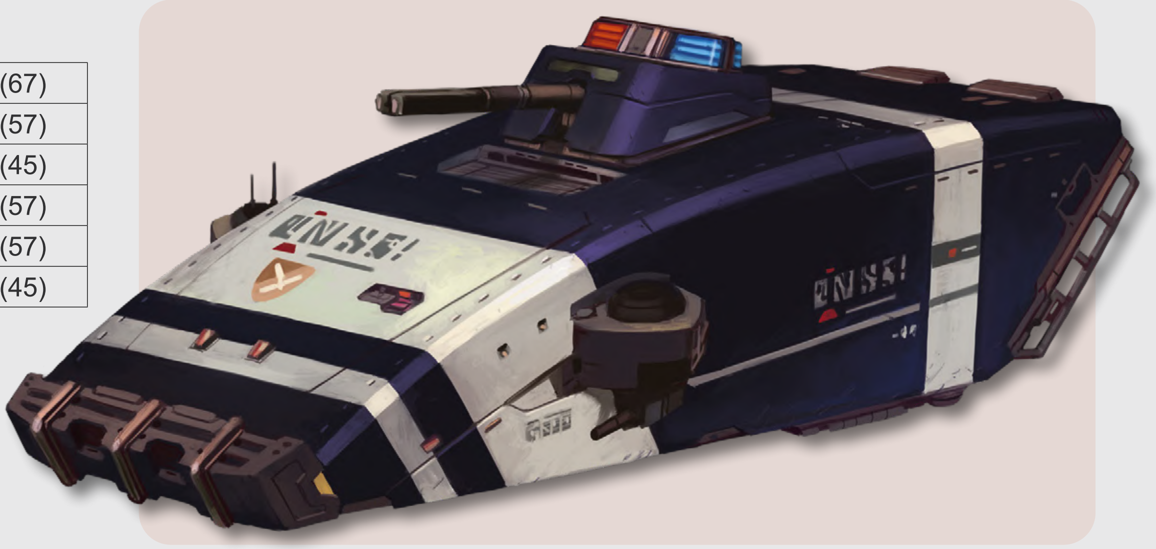
The vehicle of choice for law enforcement agencies that can afford the expense, a public safety cruiser (PSC) is armed with a heavy stun cannon with which it can sweep away civil unrest in a matter of seconds, while its built-in brig securely detains prisoners. The PSC is heavily armoured but intentionally sold without lethal weaponry. The two gun ports allow for whatever equipment a local agency deems fit to be fired from the security of a heavily armoured firing platform. The forward ram plate can break down barriers, doors and smaller vehicles, permitting extraction of suspects.

TYPE: Light Grav Vehicle (16 Spaces, DM+1 to hit)
FEATURES AND TRAITS: Responsive, Streamlined, VTOL

TL	12
SKILL	Flyer (grav)
AGILITY	+5
SPEED (CRUISE)	Very Fast (Fast)
RANGE (CRUISE)	1,900 (2,850)
CREW	2
COMFORT LEVEL	Basic Seating
CARGO	—
STRUCTURE	4
SHIPPING	8 tons
COST	MCr2.98

Armour

Forward	55 (67)
Port	45 (57)
Dorsal	33 (45)
Aft	45 (57)
Starboard	45 (57)
Ventral	33 (45)



EQUIPMENT

Autopilot (improved), Brig (small), Collision Protection (advanced) x8, Computer/1, Control System (advanced), Ejection Seat x2, Navigation System (improved), Pressurised Hull, Ram, Sensor System (enhanced), Transceiver (superior), Winch	Autopilot (skill level)	+1
	Communications (range)	500km, tightbeam, satellite uplink, encrypted
	Navigation (Navigation DM)	+2
	Sensors (Electronics (sensors) DM)	+3, 150km, high fidelity
	Camouflage (Recon DM)	—
	Stealth (Electronics (sensors) DM)	—

Weapons	Range	Damage	Magazine	Cost	Traits	Fire Control
Turret: Dorsal, Stun Cannon (heavy)	0.06	4D	—	—	Blast 20, Stun, Zero-G, Scope	+4
Gunport: Port, Personal Weapons	—	—	—	—	—	—
Gunport: Starboard, Personal Weapons	—	—	—	—	—	—
Ram: Forward	Melee	4D	—	—	AP 4	—

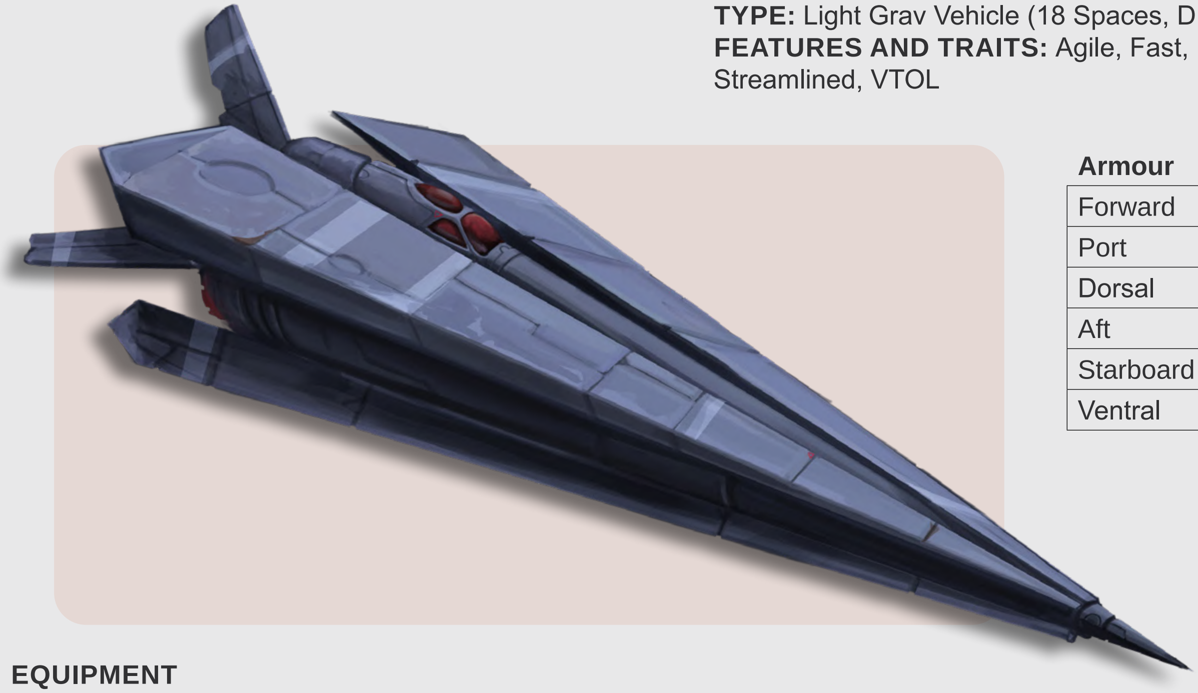
RECON SLED

Able to reach orbit in minutes or fly around nearly any world at treetop level, near invisible and with the keenest sensors, the heat-shielded recon sled can maintain orbital velocity even in an atmosphere, surviving temperatures up to 6500° C, although the plasma glow of its passage will overwhelm any attempt at stealth.

The vehicle can also move slow, hover in place and quietly listen. A pilot is optional, seated within an ejection cocoon and supported by 8Gs of inertial compensation but the sled can operate remotely, controlled from a bunker or flying autonomously to gather data. Its only armament is an anti-missile laser but stealth and speed are its main defences.

TL	13
SKILL	Flyer (grav)
AGILITY	+6
SPEED (CRUISE)	Orbital (Hypersonic)
RANGE (CRUISE)	48,400 (72,700)
CREW	1
COMFORT LEVEL	Basic Seating
CARGO	—
STRUCTURE	4
SHIPPING	9 tons
COST	MCr14.7

TYPE: Light Grav Vehicle (18 Spaces, DM+1 to hit)
FEATURES AND TRAITS: Agile, Fast, Responsive, Streamlined, VTOL



Armour

Forward	20 (33)
Port	16 (29)
Dorsal	20 (33)
Aft	16 (29)
Starboard	16 (29)
Ventral	12 (25)

EQUIPMENT

Acoustical Camouflage (advanced), Anti-Missile System: Advanced Laser (1km, 2D, Auto 4), Autopilot (advanced), Camouflage (advanced), Chemical Camouflage (advanced), Collision Protection (advanced) x4, Combat Vehicle Brain [advanced, Flyer (grav) 3, Heavy Weapon (vehicle) 4, Navigation 3, Tactics (military) 2], Computer/4: (Sensop/4), Control System (advanced), Docking Hatch, Ejection Cocoon, Fusion+ (improved, PP 0), Heat Shielding (improved), Inertial Compensator x8, Life Support Seat, Navigation System (advanced), Recon Sensor (enhanced), Sensor System (advanced), Stealth (advanced), Transceiver (superior), Vacuum Environment Protection, Vehicle Brain Interface	Autopilot (skill level)	+3
	Communications (range)	50,000km, tightbeam, satellite uplink, encrypted
	Navigation (Navigation DM)	+4
	Sensors (Electronics (sensors) DM)	+4, 25,000km, high fidelity, hardened
	Camouflage (Recon DM)	-4, 50m min range, multi-chromatic
	Stealth (Electronics (sensors) DM)	-4

RUNABOUT

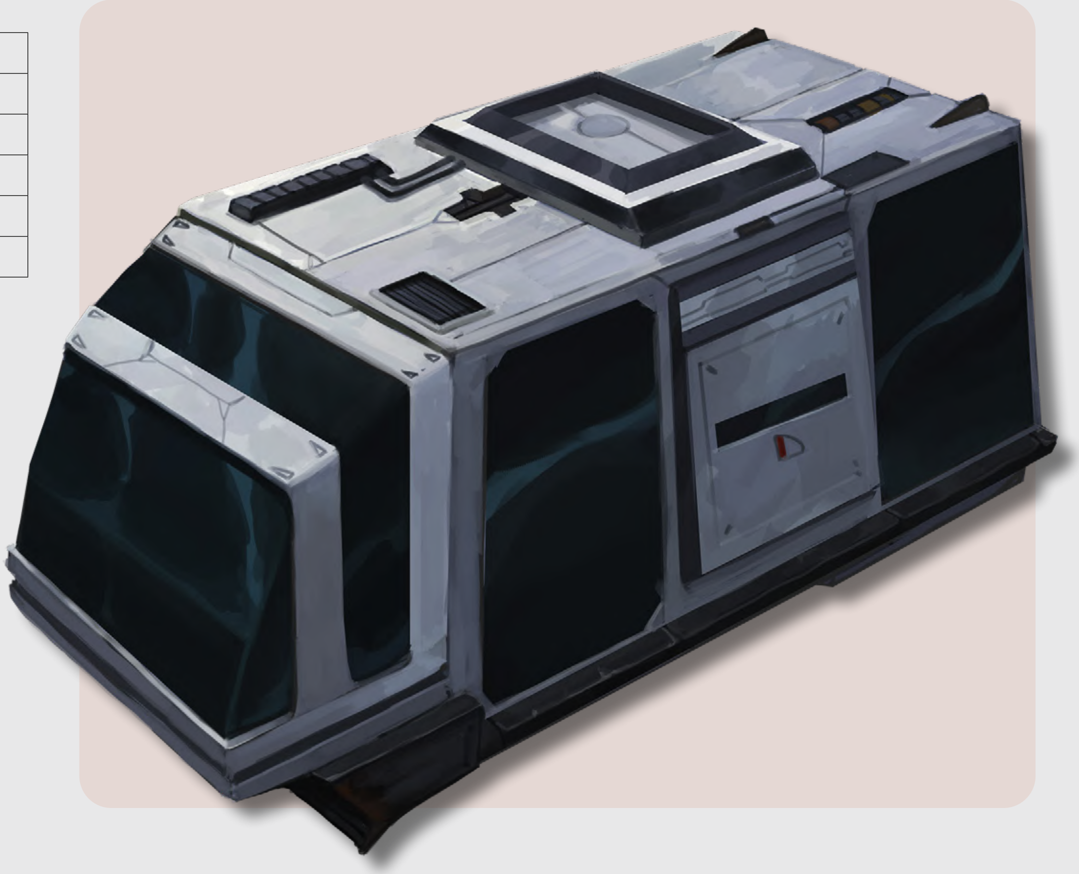
The runabout is a small grav vehicle used by crews on spacecraft, space stations and airless or hostile worlds. It has an underpowered and simple engine and only the basics in electronics and controls, but can support three occupants in vacuum conditions and has a state-of-the-art safety system. Best of all, it can fit into a docking space displacing only two tons and costs considerably less than an air/raft. It can even attach itself to the outer port of an airlock for easy access. If not carrying passengers, 0.5 tons of cargo can occupy the bench.

TYPE: Small Grav Vehicle (3 Spaces, DM+0 to hit)
FEATURES AND TRAITS: Slow, VTOL

TL	12
SKILL	Flyer (grav)
AGILITY	+1
SPEED (CRUISE)	High (Medium)
RANGE (CRUISE)	2,250 (3,380)
CREW, PASSENGERS	1, 2
COMFORT LEVEL	Basic Seating
CARGO	—
STRUCTURE	1
SHIPPING	1.5 tons
COST	Cr87000

Armour

Forward	6 (18)
Port	6 (18)
Dorsal	6 (18)
Aft	6 (18)
Starboard	6 (18)
Ventral	6 (18)



EQUIPMENT

Autopilot (basic), Collision Protection (advanced) x3, Computer/1, Control System (basic), Docking Hatch, Life Support Seat x3, Navigation System (basic), Sensor System (basic), Transceiver (superior), Vacuum Environment Protection	Autopilot (skill level)	+0
	Communications (range)	500km, satellite uplink
	Navigation (Navigation DM)	+1
	Sensors (Electronics (sensors) DM)	+0, 1km
	Camouflage (Recon DM)	—
	Stealth (Electronics (sensors) DM)	—

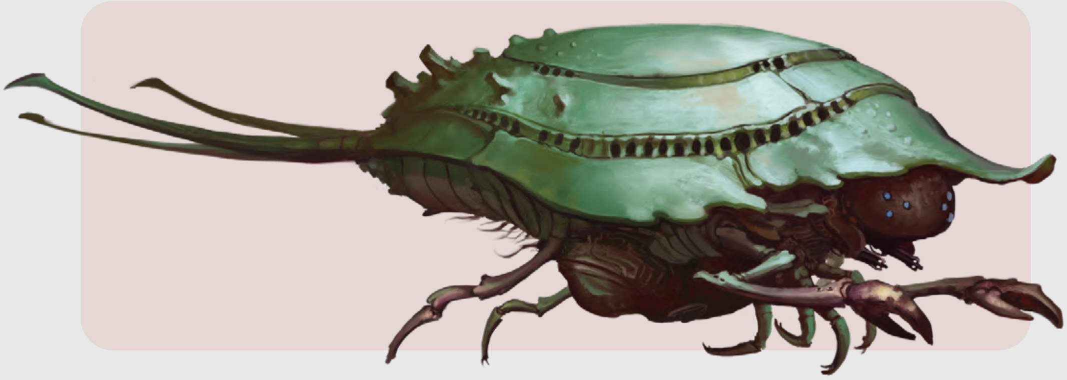
SKY DIRGE

The Sky Dirge is a strange beast, a hydrogen-filled bioconstruct airship of the Sred*Ni. The few who have visited world of I'Sred*Nihil have seen these sky creatures in the vicinity of the starport and around the few arcologies they have been permitted to visit. If clearly visible, they look like armoured bloated bugs, hanging in the sky and wheezing with a sound reminiscent of badly tuned bagpipes. Eight sets of short prickly legs allow the creature to skitter remarkably quickly on a surface.

The Sred*Ni enter the 'vehicle' through a rear hatch and seem content to occupy it for days at a time. It has no clear head, just a rounded forward face. Below a ring of six eyes are plate-covered 'jowls' with projecting arc cannons. A ventral protrusion holds what appears to be a launcher for homing spores of unknown composition and those who venture too close may be shredded by massive claws that swivel on turret-like mounts on either side of the construct.

TYPE: Heavy Airship (128 Spaces, DM+3 to hit)
Reinforced Hull
FEATURES AND TRAITS: Biotech (Ectothermic, Invertebrate), Rigid, Streamlined, VTOL

TL	12
SKILL	Flyer (airship)
AGILITY	+0
SPEED (CRUISE)	Slow (Very Slow)
RANGE (CRUISE)	27,400 (41,100)
CREW	6
COMFORT LEVEL	Basic Comfort
CARGO	—
STRUCTURE	3 (heals every 6 hours)
SHIPPING	256 tons
COST	MCr12.6



Armour

Forward	38 (50)
Port	38 (50)
Dorsal	21 (33)
Aft	21 (33)
Starboard	38 (50)
Ventral	38 (50)

EQUIPMENT

Acoustical Sensor (enhanced), Autopilot (improved), Bunk x3, Camouflage (superior), Chemical Camouflage (enhanced), Chemical Sensor (improved), Combat Vehicle Brain (basic), Control System (enhanced), Docking Hatch, Fire Extinguishers, Fresher (half), Galley (full), Ground Drive (High, 500km), Navigation System (improved), Pressurised Hull, Sensor System (improved), Stealth (basic), Transceiver (enhanced), Vehicle Brain Interface, Winch	Autopilot (skill level)	+1
	Communications (range)	500km
	Navigation (Navigation DM)	+3
	Sensors (Electronics (sensors) DM)	+1, 250km
	Camouflage (Recon DM)	-5,20m min range, vislight
	Stealth (Electronics (sensors) DM)	-2

Weapons	Range	Damage	Magazine	Cost	Traits	Fire Control
Turret x2: Forward, Arc Cannon	0.5.	1DD	—	—	AP 10, Scope	+4
Turret: Ventral, Spore Mortar	4	5D	7	—	Blast 8	+0
Hardpoint: Port, Scything Claw (heavy)	Melee	1DD	—	—	AP 20	+0
Hardpoint: Starboard, Scything Claw (heavy)	Melee	1DD	—	—	AP 20	+0

SKYSTRIKE G/FIGHTER

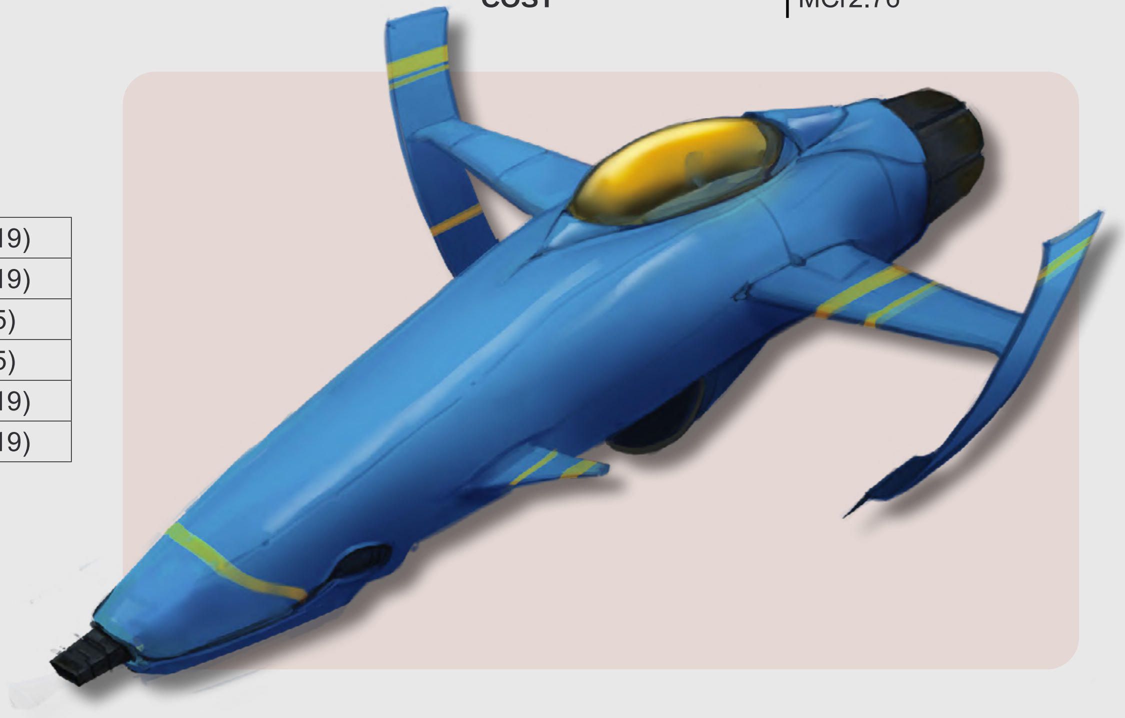
The SkyStrike is an example of an early grav vehicle designed to replace multi-role jet fighters and it retains many of the same characteristics. It has an air superiority role, using a variety of mission-specific hardpoint-mounted ordnance, and is capable of ground attack and close support with its heavy autocannon. However, especially against ground forces, pilots quickly become aware that the SkyStrike's primary defences are speed and agility, and not its thin composite skin.

TYPE: Light Grav Vehicle (14 Spaces, DM+1 to hit)
FEATURES AND TRAITS: Fast, Streamlined, VTOL

TL	9
SKILL	Flyer (grav)
AGILITY	+3
SPEED (CRUISE)	Supersonic (Subsonic)
RANGE (CRUISE)	1,500 (2,250)
CREW	1
COMFORT LEVEL	Basic Seating
CARGO	—
STRUCTURE	3
SHIPPING	7 tons
COST	MCr2.76

Armour

Forward	10 (19)
Port	10 (19)
Dorsal	6 (15)
Aft	6 (15)
Starboard	10 (19)
Ventral	10 (19)



EQUIPMENT

Ammunition Storage Space x2 (1,000 rounds), Autopilot (improved), Camouflage (improved), Computer/1, Control System (improved), Ejection Seat, Fire Extinguishers, Navigation System (improved), Pressurised Hull x2, Sensor System (improved), Stealth (improved), Transceiver (improved)	Autopilot (skill level)	+1
	Communications (range)	5,000km, encrypted
	Navigation (Navigation DM)	+2
	Sensors (Electronics (sensors) DM)	+2, 500km, high fidelity, hardened
	Camouflage (Recon DM)	-2, 200m min range, visual, IR
	Stealth (Electronics (sensors) DM)	-2

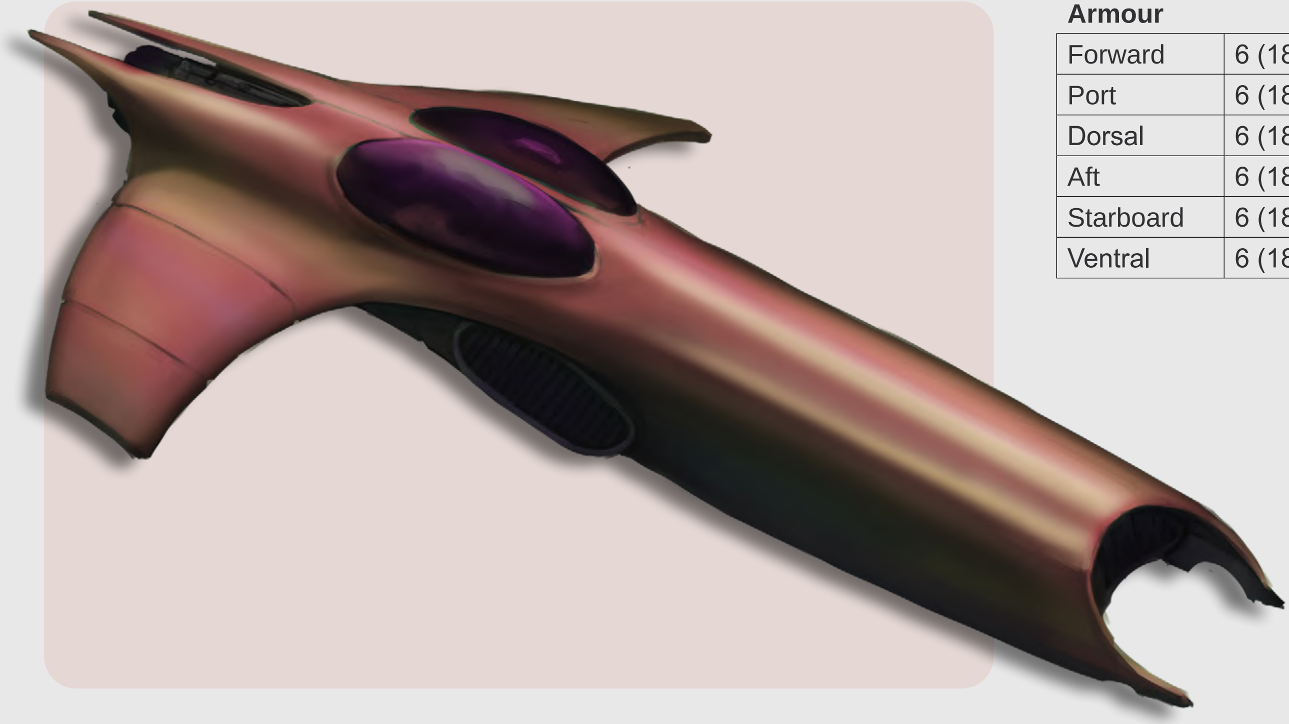
Weapons	Range	Damage	Magazine	Cost	Traits	Fire Control
Fixed Mount: Forward, Autocannon (heavy)	1	1DD	500	Cr2000	Auto 3, Scope	+2
Hardpoint: Ventral (modular) x4	—	—	—	—	—	—

SPEEDER

The speeder is a vehicle that costs more than a million Credits because it can, not because it needs to. This two-seater grav vehicle is a high-performance racer with exterior bodywork created by a noted sculptor and an interior designed by a famous interior decorator. The exterior multi-chromatic coating could be used for camouflage but usually displays full motion artistic effects.

TYPE: Light Grav Vehicle (4 Spaces, DM+1 to hit)
FEATURES AND TRAITS: Agile, Fast, Responsive, Streamlined, VTOL

TL	12
SKILL	Flyer (grav)
AGILITY	+6
SPEED (CRUISE)	Supersonic (Subsonic)
RANGE (CRUISE)	14,100 (21,100)
CREW, PASSENGERS	1, 1
COMFORT LEVEL	Good Comfort
CARGO	—
STRUCTURE	1
SHIPPING	2 tons
COST	MCr1.33



Armour

Forward	6 (18)
Port	6 (18)
Dorsal	6 (18)
Aft	6 (18)
Starboard	6 (18)
Ventral	6 (18)

EQUIPMENT

Autopilot (advanced), Camouflage (advanced), Collision Protection (advanced), Computer/3, Control System (advanced), Convertible (hard top, automatic), Docking Hatch, Ejection Seat x2, Entertainment System x40, Fusion+ (basic, PP 1), Life Support Seat x2, Luxury Exterior (SOC 11), Luxury Interior Space (advanced) x2, Navigation System (improved), Self-Sealing Hull, Sensor System (improved), Transceiver (advanced), Vacuum Environment Protection	Autopilot (skill level)	+3
	Communications (range)	5,000km, tightbeam, encrypted, satellite uplink
	Navigation (Navigation DM)	+2
	Sensors (Electronics (sensors) DM)	+1, 50km
	Camouflage (Recon DM)	-4,50m min range, multi-chromatic
	Stealth (Electronics (sensors) DM)	—

TITAN TURTLE

Titan Turtles operate on large aquatic worlds that have aquamorph, dolphin or orca populations. Uplifted kilometre-wide turtle creatures with a symbiotic seaweed and kelp forest on their back, these creatures provide a living island that periodically drops below the surface for protection and as part of its 300 year lifecycle. They have been seen in the Solomani Rim planets like Lakamsal and Noricum, along with many more in the Sufren subsector. These behemoths slowly move in tropical zones and are peaceful, except when threatened. Then the gigantic bioelectric nervous system can unleash an arc cannon shock wave from their armoured head, along with large flippers, which have 30-metre long razor sharp nails.

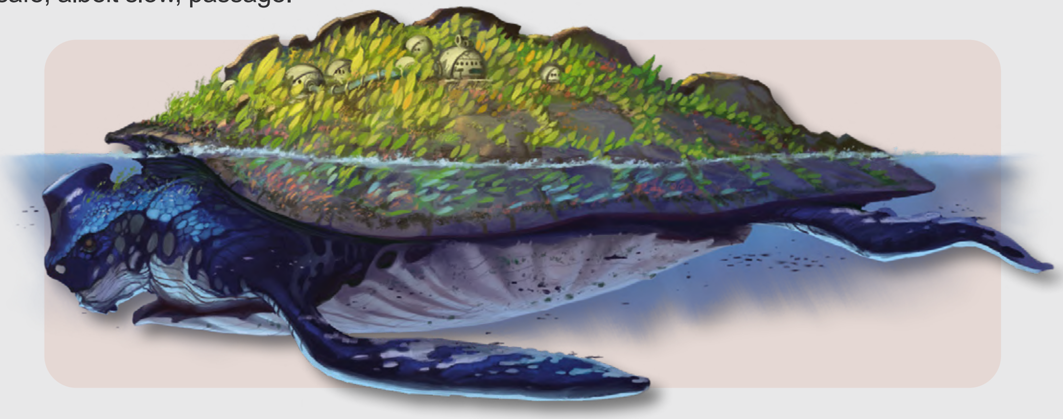
Aquamorphs who live on these living islands hollow out small homes inside the thick trunks of trees that grow on the back of the Titan Turtle. Atmospheric domes can be tethered for air-breathing sophonts and can survive the occasional submersion under the oceans. Offworld smugglers have used such communities to shift goods as these roving leviathans are hard to police and even harder to track as they move under large oceans. Spies, fugitives and Travellers wanting to escape detection have made deals with aquamorphs for safe, albeit slow, passage.

TYPE: Massive Submersible (20,000,000 Spaces, DM+6 to hit) Safe Depth 2,000m
FEATURES AND TRAITS: Biotech (Ectothermic, Vertebrate), Slow

TL	14
SKILL	Seafarer (submarine)
AGILITY	-5
SPEED (CRUISE)	Very Slow (Idle)
RANGE (CRUISE)	422 (633)
RESIDENTS	2,000
COMFORT LEVEL	Good Comfort
CARGO	2,271,499 Shipping tons hangar capacity (or 4,542,998 tons for cargo)
STRUCTURE	6,000,000 (heals every 12 hours)
SHIPPING	10,000,000 tons
COST	MCr7140000

Armour

Forward	27 (41)
Port	26 (40)
Dorsal	24 (38)
Aft	27 (41)
Starboard	26 (40)
Ventral	24 (38)



EQUIPMENT

Aquatic Internal Environment, Autopilot (basic), Biosphere (x2,000), Control System (basic), Navigation System (basic), Self-Repairing Hull, Sensor System (basic), Sensor System (enhanced, underwater)	Autopilot (skill level)	+0
	Communications (range)	—
	Navigation (Navigation DM)	+2
	Sensors (Electronics (sensors) DM)	+0, 1km; Underwater: +4, 8km
	Camouflage (Recon DM)	—
	Stealth (Electronics (sensors) DM)	—

Weapons	Range	Damage	Magazine	Cost	Traits	Fire Control
Fixed Mount: Forward, Arc Cannon	0.5	1DD	—	—	AP 10, Scope	+1
Hardpoint: Port, Scything Claw (massive, monofilament), modular	Melee	3DD+30	—	—	AP 35	+0
Hardpoint: Starboard, Scything Claw (massive, monofilament)	Melee	3DD+30	—	—	AP 35	+0

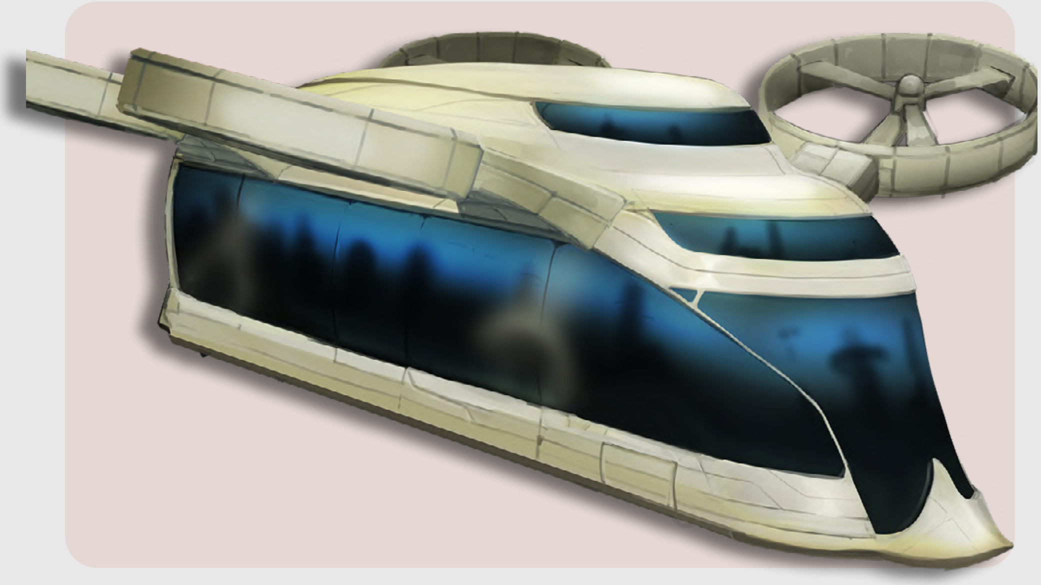
VYRTYBYRD TOURING RV

Vyrtybyrd Aerodyne recreational vehicles are popular on worlds that do not have a large gravitic infrastructure. The touring model is equally geared for entertainers on a circuit, dignitaries doing whistle stops or the wealthy commercial magnate taking the family on holiday. In addition to eight passengers, who must share staterooms, a driver and three staff are accommodated. The generous two tons of storage holds most entertainers' equipment or vast amounts of camping gear.

Floats allow the RV to become a houseboat for a quiet weekend of fishing and acoustical camouflage is calibrated to reduce the RV's signature both inside and out. There is a docking space for a ground car but no self-respecting socialite would dare park anything less than a Cr23000 vehicle inside a Vyrtybyrd. That said, a few of the more outdoorsy types have ordered their bays configured for small boats of similar size.

TYPE: Heavy Rotorcraft (100 Spaces, DM+3 to hit)
FEATURES AND TRAITS: Aerodyne, Floats, VTOL

TL	8
SKILL	Flyer (rotor)
AGILITY	+0
SPEED (CRUISE)	Medium (Slow)
RANGE (CRUISE)	3,080 (4,610)
CREW, PASSENGERS	4, 8
COMFORT LEVEL	Good Comfort
CARGO	2 tons, 3 Shipping tons docking capacity (or 3.5 tons for cargo)
STRUCTURE	5
SHIPPING	50 tons
COST	MCr6.11



Armour

Forward	3 (11)
Port	3 (11)
Dorsal	3 (11)
Aft	3 (11)
Starboard	3 (11)
Ventral	3 (11)

EQUIPMENT

Acoustical Camouflage (improved), Autopilot (improved), Collision Protection (basic) x60, Common Space x9, Computer/1, Control System (improved), Docking Hatch x3, Entertainment System x10, Fire Extinguishers, Fresher (full) x2, Fresher (half), Galley (gourmet) x2, Galley (mini), Luxury Exterior (SOC 10), Luxury Interior Space (improved) x8, Navigation System (basic), Pressurised Hull, Sensor System (basic), Sleeping Berth x4, Stateroom (improved) x4, Transceiver (enhanced)	Autopilot (skill level)	+1
	Communications (range)	500km, satellite uplink
	Navigation (Navigation DM)	+1
	Sensors (Electronics (sensors) DM)	+0, 1km
	Camouflage (Recon DM)	—
	Stealth (Electronics (sensors) DM)	—

VOIDSAILOR MOBILE HOME

Rather than relying on expensive lifters and advanced technologies, the VoidSailor is built around a sturdy vacuum balloon, a spheroid with nothing inside, lowering the density of the vehicle to the point where it can float better than the best balloon. A series of sails control flight direction and altitude using actuators powered by a small Fusion+ generator refuelled by rainwater. It consists of a two-bedroom apartment with a small solarium and hot tub area that can open or close with a change in the weather. Backup locomotion is a full parasail package for controlled landings in emergencies and there are two docking hatches for visiting grav vehicles.

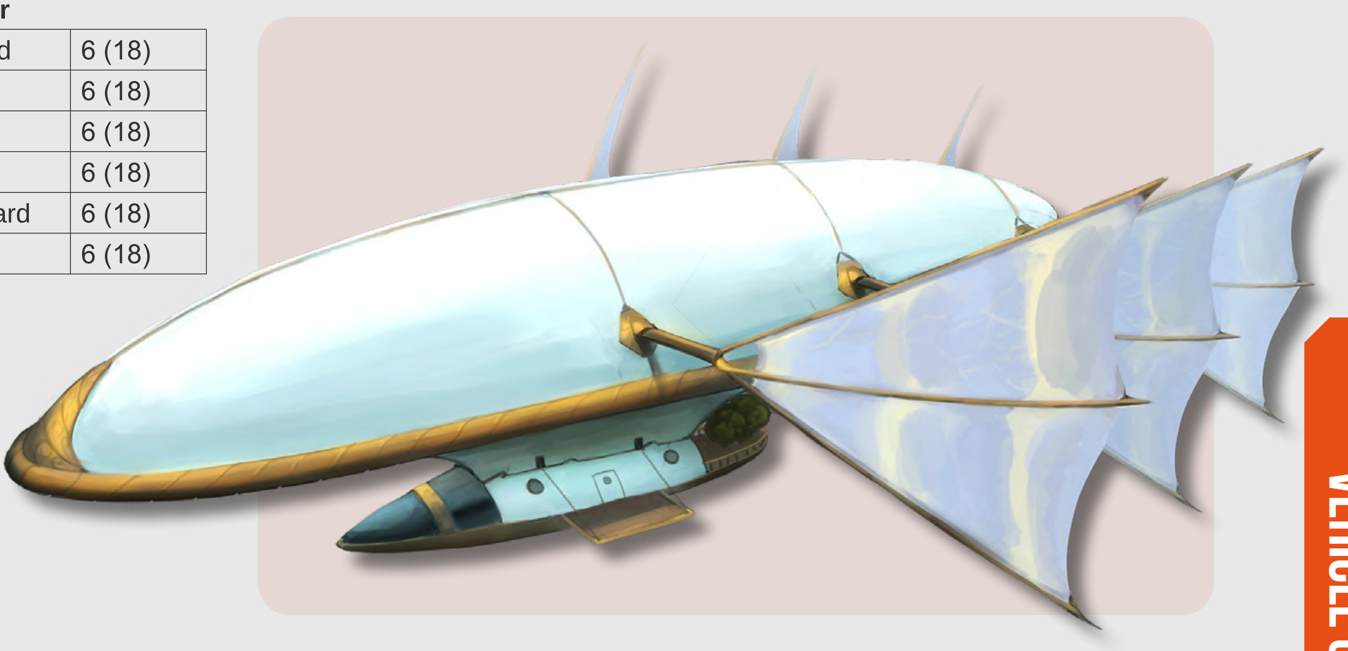
For Cr43000, a pressurisation option adds protection from Tainted and Very Thin atmosphere and flights up to 20 kilometres altitude. For Cr86000 it can instead operate in Trace atmospheres and altitudes up to 60 kilometres but the envelope does not permit flight to that altitude unless gravity is considerably lower than standard.

TL	12
SKILL	Flyer (airship)
AGILITY	-4
SPEED (CRUISE)	Medium (Slow)
RANGE (CRUISE)	n/a
PASSENGERS	4
COMFORT LEVEL	Good Comfort
CARGO	1 ton
STRUCTURE	5
SHIPPING	43 tons
COST	Cr554000

TYPE: Huge Airship (215 Spaces, DM+4 to hit, Vacuum Envelope)
FEATURES AND TRAITS: Streamlined, Unresponsive, VTOL

Armour

Forward	6 (18)
Port	6 (18)
Dorsal	6 (18)
Aft	6 (18)
Starboard	6 (18)
Ventral	6 (18)



EQUIPMENT

Autopilot (basic), Common Space x4, Computer/1, Control System (basic), Docking Hatch x2, Entertainment System x40, Fresher (full), Galley (gourmet), Navigation System (basic), Recreational: Garden Space (5), Secondary Power: Fusion+ (basic, PP 10), Sensor System (basic), Stateroom (enhanced) x2, Transceiver (superior), Vehicle Parachute (improved), Wind Powered	Autopilot (skill level)	+0
	Communications (range)	500km, satellite uplink
	Navigation (Navigation DM)	+1
	Sensors (Electronics (sensors) DM)	+0, 1km
	Camouflage (Recon DM)	—
	Stealth (Electronics (sensors) DM)	—

APPENDIX I

VEHICLE DESIGN EXAMPLE

The Heavy Landing Craft (HLC) is an example of a more complicated vehicle. Here we illustrate the compromises that often arise when working within limitations and the changes that result. It also shows examples of using the weapon system design sheet.

STEP 1 DEFINE THE PURPOSE

The HLC needs to be able to survive attacks from infantry and light armour units and move over both rough terrain and water conditions while transporting a driver and 12 troops, one or more of whom can also act as weapon operators. It must be able to withstand combat damage and be armed to provide supporting fire for its troops. The projected budget for the vehicle is Cr500000.

STEP 2 DETERMINE THE TECH LEVEL

The vehicle must be built at TL7.

STEP 3 PICK A VEHICLE TYPE

A ground vehicle with aquatic capability is the preferred vehicle type. It does not require environmental support for its troops and is not expected to operate entirely submerged.

STEP 4 PICK A SIZE IN SPACES

The vehicle should be at least 20 Spaces to support its occupants and Heavy vehicle features, but size limitations based on existing transport and production capabilities need to be considered before expanding this size.

STEP 5 CHOOSE FEATURES

The HLC is a military vehicle, so it makes sense to add the AFV trait for the increase in Hull alone. It can also support Armour 90 instead 30, although it might not need to take advantage of all of that. AFV also grants the Off-Roader trait but adding ATV or Tracks to make it better able to handle rough terrain makes sense. ATV is cheaper, despite Tracks being better in the worst terrain. To provide a bigger pool of potential skilled wheeled vehicle drivers, this design will use the ATV trait.

AFV also slows the vehicle. To counteract that, the design will incorporate Fast and Streamlined, each adding one Speed Band and returning the HLC to Medium as its maximum Speed Band. Fast also decreases the Range to 250km. The design could also incorporate the Responsive trait to allow it to accelerate faster, but this would even further reduce Range. Instead, adding the Agile feature increases the vehicle's Agility to +1. Each feature adds to the vehicle's Cost: AFV (+100%), Agile (+100%), ATV (+30%), Fast (+100%) and Streamlined (+200%), for a total of +530% of Cr15000 or Cr79500.

STEP 6 CHOOSE CUSTOMISATION

Adding custom power systems at TL7 is not a good trade-off. A fission power plant is available but it eats up half the entire craft and makes it too expensive and hazardous to contemplate. The HLC requirements call for an aquatic drive, which consumes one Space for Cr30000. Theoretically, it could add a third mode of locomotion but neither rail wheels, submarine drive or rocket thrusters seem necessary or prudent.

Because Space is potentially an issue when fitting 13 people inside the vehicle, any speed or Range options consuming Spaces are not good prospects but by increasing the HLC's fuel efficiency to +2, the Range will return to 500 kilometres at a cost of 50% of the vehicle base Cost, or Cr7500. It could be increased further but the designer should be cost-conscious and an amphibious fighting vehicle is more likely to be fighting near the shore than driving vast distances.

STEP 7 ARMOUR AND STRUCTURAL REINFORCEMENT

At TL7 base armour is only +3 and the vehicle is intended for combat. However, after accounting for 13 people, there are only six Spaces left. Wanting to hold two Spaces back for a possible weapon, cargo or miscellaneous system, the designer decides that four Spaces can go to armour. This only allows a total of +20 to be added, regardless of being an AFV (but AFV still provides more Hull, making the vehicle able to withstand more damage). The default for added armour adds +20 to forward, aft, port and starboard but only +10 to the dorsal and ventral faces. This does not seem to be enough to withstand heavy weapons – a TL7 heavy cannon can deal 2DD or an average of 70 points, so the HLC cannot withstand the line of battle. Even if 30 points, 10 each from the aft, port and starboard, were added to the front, it would only be able to withstand 53 points with its forward armour. The designer decides this is just not appropriate and using another Space will not add enough (+5) to make a difference. Instead, a greater proportion of the vehicle's bulk will need to go to armour. This means either decreasing the number of troops carried, crowding them in, or increasing the size of the vehicle.

The next step would depend on which factors the designer can control:

- If a squad of 12 and a driver are the standard for this unit, it would require an organisational change across an entire military organisation to reduce troop size.
- Making the vehicle more cramped would make movement and actions within the vehicle difficult.
- Making the vehicle bigger could be limited by the size of roads, transport vehicles or even production lines.

In this case, we will assume that organisational and external factors cannot be changed. All that can be done is to crowd the crew. Leaving the driver's Space at one and allowing for a gunner position for a yet-undefined weapon to also avoid crowding, the other 11 can crowd into half a Space – since Spaces used round up, the designer loses nothing by adding a third seat – a squad commander gets a full Space and leaves 10 poor soldiers with only 0.5 Spaces, using eight instead of 13 Spaces for all occupants. This will reduce the Comfort Level below 1, leading to Uncomfortable Seating for the 10, with DM-1 to all actions after four hours and another DM-1 for each additional hour crammed in the confines of a landing craft.

Now, leaving two Spaces in reserve, another 5 are available for armour, adding +45 to the vehicle's overall armour. The default application of armour leaves four faces at +48, with dorsal and ventral at +25. In this case, the two sides give five points, the aft 10 points and the ventral and dorsal each one point to the forward armour, increasing it to +70 and allowing an even chance to stop a main battle tank's weapon and near immunity to a 1DD attack. This level of armour consumes nine Spaces and adds Cr112500.

The option to add a reinforced hull at only half base Cost or Cr7500 seems a bargain and it gives the vehicle another 6 Hull.

Looking at the vehicle realistically, there is little chance that something so heavy could float, even with flotation devices. It makes more sense to change the secondary drive from aquatic to submarine. It could then drive across the bottom, crossing rivers with ease and even rolling off a transport ship to approach a beach from underwater, driving across the submerged terrain. This consumes another Space and costs twice as much as the aquatic drive but gives the vehicle a unique capability, although without life support it cannot remain deeply submerged for more than three hours (half the TL, rounded down). The AFV trait also grants it equivalent safe and crush depths to a regular submersible.

After all this, there is no Space allocated for cargo, although a single Space for a weapon remains.

STEP 8 CHOOSE CUSTOMISATION

This step includes three different categories of options: Core, External and Internal.

STEP 8A (CORE OPTIONS)

The remaining Space is being held back for a weapon, so only zero Space options can be considered. First, looking at controls, they are limited by TL7 to no better than Improved; this choice costs Cr5000 and raises the vehicle's Agility to +2.

An autopilot seems unnecessary, and not that helpful at TL7, but it could be useful for a vehicle to continue to operate if the driver is incapacitated. It could save the day to have an Improved autopilot for Cr7500.

A 500-kilometre transceiver could be useful and is Cr300 at TL7. There are no Spaces available for a satellite uplink (at TL8 it would not require a Space) and tightbeam is not available, so the only available option is encrypted, increasing the cost to Cr4300.

Only a Basic navigation system is available at TL7, for Cr2000.

Sensors can be Improved, giving them a Range of 5 kilometres and DM+1. There are no Spaces to spare for high fidelity or a sensor mast and hardening sensors seems unnecessary. Most enemies will be visually sighted if sensors are being jammed. This sensor system costs Cr15000. For an HLC with a submarine drive, a comparable underwater sensor system is not unreasonable. It is, however, twice the Cost for half the Range.

A military vehicle should spend money on camouflage and Improved TL7 camouflage provides DM-2 to detection for another Cr10000.

Even Basic stealth, all that is available at TL7, is Cr100000 but it could make a difference, especially if approaching from underwater. Still, it is an expensive option, so let us hold off until we add all the costs.

STEP 8B (EXTERNAL OPTIONS)

Examining environmental protections, hostile environment protection is included with the submarine drive option. A TL7 vehicle is generally designed for a specific world, so adding additional protection seems unnecessary and 'fancier' options require a higher Tech Level.

To facilitate a rescue if the HLC is trapped underwater, a docking hatch seems a wise investment. It is assumed to be a rear hatch – the same door troops would use to enter and exit the vehicle. A tow hitch to drag other vehicles is also added. It should be able to at least pull its own weight, so 20 Spaces worth is added for only Cr400. Nothing else that meets the criteria of consuming no Spaces is available at TL7 seems useful for a combat vehicle.

The HLC could benefit from active defence options but with no Spaces to spare and a limitation of TL7, one of the few choices is reactive armour, which seems odd for an amphibious vehicle and could lead to a discussion on how well it would work submerged. Adding an acoustical sensor to increase its ability to detect distant underwater signatures is a possibility but one best fitted on a command or support vehicle.

STEP 8C (INTERNAL OPTIONS)

The HLC has no Spaces available (still holding one back for a weapon) and is limited to TL7. The bad news is that it leaves no room for life support unless added to every seat at Cr5000 per seat, so the submersible aspect of the vehicle is only usable for half of its Tech Level, rounded down, or three hours.

Other options are possible but although legitimate, they strain credibility for what is basically an amphibious armoured personnel carrier. Among these are collision protection, ejection seats and an entertainment system. In the end, none of these are added, despite the fact that an entertainment system would increase the Comfort Level. The collision protection system has the downside of potentially stalling the vehicle for 1D rounds after a collision – not a good idea for a combat vehicle – but fire extinguishers are a good low cost, 0 Space option.

STEP 9 CHOOSE AUTOMATION

The HLC could have a computer installed but it would be a Computer/0 for Cr1000. This does not seem useful.

STEP 10 CHOOSE WEAPONS

The HLC needs a weapon and with one Space available, the logical choice in a vehicle that needs to operate fully submerged is a weapon in a remote turret. A single Space turret can support a weapon up to four times its size, so any TL7 or earlier weapon of 4 Spaces or smaller is a possible choice. The vehicle can also install weapons on hardpoints on the vehicle's surface without using any Spaces. The total mass of weapons for a vehicle without affecting performance is 100 kilograms per Space or 2,000 kilograms total. Since even a four Space weapon only counts as one ton, up to another 1,000 kilograms of hardpoint weaponry can be installed.

The turret weapon chosen is a heavy autocannon. At TL7, a Basic fire control system adds DM+1 to attack rolls. The total cost with weapon, remote gunnery station and fire control is Cr75500. It technically requires a loader but with a magazine load of 100 rounds, it has no extra ammunition to reload or Spaces to store any. The turret is placed on the dorsal

WEAPON SYSTEMS DESIGN

System:	Dorsal turret Autocannon			**Spaces**	**Cost**
Mount:	Turret	***Side:***	Dorsal	1	20000
Weapon:	Autocannon (heavy)	***Quantity:***	1	—	45000

	Number	***Loaders***	***Remote Gunner?***	***Autoloader?***		
Crew:	1	—	Yes	n/a	—	500

Gun Shield?	n/a	***Armour:***	n/a		
Fire Control System:	Basic (+1)	***Other Crew:***			10000
			Mount Spaces:	1	75500
Modular?	No	***Pop-up?***	No		

#Crew in Mount:	0	**#Crew in Vehicle:**		1	**Ammunition Storage Spaces:**	0	
Range (km):	1	**Damage:**	1DD	**Magazine:**	100		2000
Rate of Fire:	3	**Traits:**	Auto 3, Scope		**Rounds per Space:**	500	

surface, allowing it to fire even if the vehicle is mostly submerged. This weapon is detailed with the Weapons System Design worksheet.

For hardpoints, the second 1,000 kilograms of weapons goes to two medium rocket pods, mounted port and starboard, but pointing forward. They also get a Basic fire control system and remote gunnery station, co-located with the vehicle commander for Cr24500 each. Whether or not the rockets can be fired underwater is for the Referee to decide.

Now the designer has another decision to make; with hardpoints, stealth suffers to the point of uselessness (see page 61). Realistically, the vehicle can have either Basic Stealth at Cr100000 *or* one or more hardpoints. Given the marginal utility and high cost of DM-1 for stealth and a chance to add more firepower, the decision is made to dispense with the stealth coating and install the rocket pods. The weapon and vehicle design sheet entries for the rocket pods will look like this:

WEAPON SYSTEM DESIGN

System:	Rocket Pod Hard Point (facing forward)			**Spaces**	**Cost**
Mount:	Hard Point	***Side:***	Port/starboard	—	2000
Weapon:	Rocket Pod (medium)	***Quantity:***	1	—	12000

	Number	***Loaders***	***Remote Gunner?***	***Autoloader?***		
Crew:	1	—	Yes	n/a	—	500

Gun Shield?	n/a	***Armour:***	n/a		
Fire Control System:	Basic (+1)	***Other Crew:***			10000
			Mount Spaces:	1	24500
Modular?	—	***Pop-up?***	—		

#Crew in Mount:	0	**#Crew in Vehicle:**	1	**Ammunition Storage Spaces:**		0	
Range (km):	2	**Damage:**	6D	**Magazine:**	100		8000
Rate of Fire:	3	**Traits:**	Auto 3, Blast 10, Scope	**Rounds per Space:**	900		

And the Weapons section of the Vehicle Design Sheet looks like this:

Weapon	Range	Damage	Magazine	(Cost)	Traits	Spaces	Cost
Turret (Autocannon (heavy)), dorsal	1km	1DD	100	2000	Auto 3, Scope (+1)	1	75500
Hard Point Rocket Pod (medium), port	2km	6D	9	8000	Auto 3, Blast 10, Scope (+1)	—	24500
Hard Point Rocket Pod (medium), starboard	2km	6D	9	8000	Auto 3, Blast 10, Scope (+1)	—	24500

STEP 11 ALLOCATE OCCUPANT SPACES

The HLC allocates 1 Space of each of its three crew (driver, gunner, commander) and only 0.5 Spaces for each of its 10 troopers.

The total of 8 allocated occupant Spaces provides an overall comfort level of only 0.62 for all 13 occupants but is effectively 1.0 for crew and 0.5 for troops. This is sufficient for the crew to operate without penalty for 8 hours but only four hours for the troopers, who will hopefully be able to exit their cramped accommodations quickly, especially since the vehicle will only support them for three hours of underwater operation.

STEP 12 ALLOCATE CARGO SPACE

The HLC does not allocate Spaces for cargo. If it needs to carry equipment, it will come at the expense of the already cramped troops area.

STEP 13 RECORDING AND RATING THE VEHICLE

The completed worksheet for the HLC looks like page 180.

And the final table for the vehicle looks like next page 181.

Vehicle Design Worksheet			**TL:** 7			**Spaces**	**Cost**
Vehicle Name:	Heavy Landing Vehicle (HLC)				**Totals**:		481600
Type:	Ground vehicle			**Skill:**	Drive (wheel)	20	15000
Features:	Agile, AFV, ATV, Fast, Streamlined						79500
Power system(s):	Powered						
Auxiliairy Drive(s):	Submarine Drive (Idle, 75km, Safe depth 300m, Crush depth 900m, Hostile environment)					-2	60000
Armour:	***Base:***	+3	***Added:***	+45			
Forward:	70 (77)	**Aft:**	38 (45)	**Speed Modification:**			
Port:	43 (50)	**Starboard:**	43 (50)	**Range Modification:**	Fuel Efficient (+2)		7500
Dorsal	24 (31)	**Ventral:**	24 (31)	**Hull Modification:**	Reinforced Hull		7500

Controls:	Improved (Agility +1)		5000
Agility (skill level):	Improved (+1)		7500
Communications (range):	500km, encrypted		4300
Navigation (navigation DM):	Basic (+1)		2000
Sensors (electronics (sensors) DM):	Improved +1, 5km, Underwater, Improved +1, 2.5km		45000
Camouflage (Recon) DM:	Improved -2, 200m min range, Visual, IR		10000
Stealth (electronics (sensors) DM):			

Equipment	**Notes**	**Spaces**	**Cost**
Docking Hatch	Aft		500
Tow hitch	20 Spaces		400
Fire Extinguishers	20 spaces		400

Weapon	**Range**	**Damage**	**Magazine**	**(Cost)**	**Traits**	**Spaces**	**Cost**
Turret (Autocannon (heavy)), dorsal	1km	1DD	100	2000	Auto 3, Scope (+1)	1	
Hard Point rocket Pod (medium) Port	2km	6D	9	8000	Auto 3, Blast 10, Scope (+1)		24500
Hard Point rocket Pod (medium) starboard	2km	6D	9	8000	Auto 3, Blast 10, Scope (+1)		24500

Description

The heavy landing craft is an amphibious combat vehicle designed to deliver a squad of infantry onto beaches across shallow seas and rivers while withstanding the rigours of mechanised warfare. Armed with an autocannon and twin rocket pods and armoured to withstand heavy fire towards its front, it is often called the 'Hellish Lumbering Coffin' by the troops forced to sit claustrophobically close in its crew compartment. Too heavy to float without auxiliairy bladders, this wheeled vehicle can propel itself underwater or drive on the sea or the river floor up to 100 metres deep for as long as three hours before the air becomes hazardously fouled. Once delivered to a combat zone, its troopers are almost relieved to pour out onto the hostile landscape where they can at least stretch and breathe while supported by the HLC's weapons.

Vehicle Display Sheet: Heavy Landing Craft (HLC)					
Type	Heavy Ground Vehicle (20 Spaces, DM+2 to hit) Reinforced Hull				
Features and Traits	AFV, Agile, ATV, Fast, Streamlined				
TL	7	**Armour**			
Skill	Drive (wheel)	**Forward:**	70 (77)	**Aft:**	38 (45)
Agility	+2	**Port:**	43 (50)	**Starboard:**	43 (50)
Speed (cruise)	Medium (Slow)	**Dorsal:**	24 (31)	**Ventral:**	24 (31)
Range (cruise)	500 (700)				
Crew, Passengers	3, 10				
Comfort Level	**Crew**: Basic Seating; **Passengers**: Uncomfortable Seating				
Cargo	—				
Hull [Structure]	66 [7]				
Shipping	10 tons				
Cost	Cr480000				

Autopilot (skill level)	+1
Communications (range)	500km, encrypted
Navigation (Navigation DM)	+1
Sensors (Electronics (sensors) DM)	+1, 5km; Underwater: +1, 2.5km
Camouflage (Recon DM)	-2, 200m min range, visual, IR
Stealth (Electronics (sensors) DM)	—

Equipment
Autopilot (improved), Camouflage (improved), Control System (improved), Docking Hatch, Fire Extinguishers, Navigation System (basic), Sensor System (improved), Sensor System (improved, underwater), Submarine Drive (Very Slow, 75km), Tow Hitch x20, Transceiver (improved)

Weapon	**Range**	**Damage**	**Magazine**	**(Cost)**	**Traits**	**Fire control**
Turret (Autocannon (heavy)), dorsal	1km	1DD	100	2000	Auto 3, Scope (+1)	+1
Hard Point rocket Pod (medium) Port	2km	6D	9	8000	Auto 3, Blast 10, Scope (+1)	+1
Hard Point rocket Pod (medium) starboard	2km	6D	9	8000	Auto 3, Blast 10, Scope (+1)	+1

Description
The heavy landing craft is an amphibious combat vehicle designed to deliver a squad of infantry onto beaches across shallow seas and rivers while withstanding the rigours of mechanised warfare. Armed with an autocannon and twin rocket pods and armoured to withstand heavy fire towards its front, it is often called the 'Hellish Lumbering Coffin' by the troops forced to sit claustrophobically close in its crew compartment. Too heavy to float without auxiliairy bladders, this wheeled vehicle can propel itself underwater or drive on the sea or the river floor up to 100 metres deep for as long as three hours before the air becomes hazardously fouled. Once delivered to a combat zone, its troopers are almost relieved to pour out onto the hostile landscape where they can at least stretch and breathe while supported by the HLC's weapons.

APPENDIX II

TRAINS & RAIL NETWORKS

A train is comprised of linked vehicles, usually running on a track. For some applications, such as light rail, all vehicles may be powered and use the Rail Rider feature (see page 41) to stay on the tracked surface. In other cases, one or more locomotives tow multiple carriages. The towing rules (see page 23) apply here.

Many trains use a vehicle with the Locomotive feature (see page 38) to tow unpowered or grid powered carriages. In many applications, especially 'light rail' in urban environments, all vehicles might be powered running over a rail system. These are treated as independent Rail Rider ground vehicles but can take advantage of the features of various track types.

A rail network consists of tracks designed to support rail-riding vehicles, with defined routes and switching systems to allow traffic control. At lower Tech Levels switching systems are mechanical in nature but they become automatic or at least remotely controlled as communications improve. A rail network has a maximum safe Speed Band, which varies with rail type, investment and technology. Doubling the cost of a rail track will increase the maximum safe Speed Band by one, and the maximum safe Speed Band also increases at TL+2 from its introduction.

If a Rail Rider is operating beyond the railway's maximum safe Speed Band, the operator must make an Average (8+) check every minute to avoid a mishap, with an additional DM-2 for every additional Speed Band. Mishaps can include damage to equipment (a Severity 1 Critical Hit to Locomotion) or a derailment, an event which is treated as a collision at one Speed Band slower than the Speed Band at which the mishap occurred.

RAIL (PRIMITIVE)

At TL1 rails can be constructed out of wood and metal. They allow a Rail Rider to apply its +1 Speed Band bonus but do not provide a bonus to towing capacity. In most instances towing power is produced by muscle power of people or draft animals and their speed is the true limiting factor. Maximum safe speed is Very Slow.

RAIL (BASIC)

At TL3, with the advent of iron rail networks and steam-powered locamotives, not only do the Rail Riders apply the +1 bonus to their Speed Band but reaching those speeds under mechanical power is possible. Towing capacity for a Rail Rider towing other Rail Rider vehicles on the same track is doubled. This stacks with a Locomotive's bonus, allowing a total of eight Spaces of towed vehicle, or x16 Spaces of unpowered towed vehicles per decrease in Speed Band. At TL5, rail can provide grid power to any Rail Rider equipped to receive it, including locomotives.

RAIL (IMPROVED)

Use of better materials and electronic control systems at TL7 allows a rail network to operate at higher speeds. While this does not improve towing capacity, it does allow for faster transport across longer distances, competing directly with air transport service at a generally lower price.

RAIL (ENHANCED): MAGLEV

At TL8 magnetic monorail tracks use electromagnets to support the Rail Rider above its monorail track. A maglev Rail Rider must have a power source, although it can use grid power provided by induction from the track itself to keep running. A maglev Rail Rider is not compatible with other types of railed tracks. The lowered friction adds another Speed Band to the vehicle's maximum and doubles towing capacity from that of a Basic rail system, so a Locomotive can tow x16 its Spaces of fully powered vehicles or x32 its Spaces of vehicles powered only by the monorail grid. A maglev locomotive is almost always grid powered and as the grid itself provides power, Range is effectively infinite. Any Rail Rider must have the Streamlined feature to travel beyond Subsonic speeds in an atmosphere.

RAIL (ADVANCED): GRAVLEV

Although rarely implemented, a gravlev rail system available at TL13 uses short-range grav repulsors to accelerate lifter-equipped Rail Riders along a track. All vehicles taking advantage of a gravlev railroad must have the Rail Rider feature, grid power as at least a secondary power source and lifters as a secondary

Train Summary

Railroad	TL	Speed Band	Maximum	Towing Bonus	Notes
Rail (primitive)	1	+1	Very Slow	None	Muscle power
Rail (basic)	3	+1	Slow	x2 Spaces	Can use grid power at TL5+
Rail (improved)	7	+2	Very Fast	x2 Spaces	Designed for high-speed rail
Rail (enhanced): Maglev	8	+3	Subsonic	x4 Spaces	All Rail Riders require grid power
Rail (advanced): Gravlev	13	+4	Supersonic	x5 Spaces	All Rail Riders require grid power and lifters
Vacc Tube rail	8	+2 (additional)	+2 (additional)	Same	Rail Riders should have vacuum protection and life support

locomotion mode. The maximum Speed Band of gravlev vehicles is increased again and the towing capacity of locomotive is now five times that of a standard locomotive (x20 or x40). Supersonic gravlev vehicles must be Streamlined in an atmosphere.

VACC TUBE RAIL

Available at TL8, this rail line is enclosed in an evacuated tube, able to function without air friction and have its Speed Band increased by two while not requiring to be Streamlined. Evacuated railroads are expensive and all cars must have vacuum protection and life support installed unless they are carrying cargo that is vacuum safe. A railroad on a world without an atmosphere gains the advantages of a tube railroad without the expensive tube infrastructure.

Urban and arcology environments sometimes develop light rail systems for short range passenger travel. These rail networks cannot support any Rail Riders of more than 40 Spaces or that have the Locomotives or AFV Features.

RAIL NETWORKS

A rail network relies on an infrastructure of railway tracks, stations and switching equipment, not to mention a power source to provide grid power to any train systems from TL5 or above that use grid power. The Rail Network Types table provides the cost per kilometre and any other considerations for various rail lines. Standard maintenance costs are 1% of the rail network's cost per year. This includes personnel, stations, power and other directly related costs.

Rail Network Types

Train/Railroad	TL	Cost per Km	Notes
Rail (primitive)	1	Cr50000	Double maintenance costs
Rail (basic)	3	Cr100000	+40% if providing grid power
Rail (improved)	7	Cr200000	+20% if providing grid power
Rail (improved): Maglev	8	Cr400000	Includes power costs
Rail (advanced): Gravlev	13	Cr500000	Includes power costs
Vacc Tube rail	8	+MCr5	Cost for tube tunnel. No increased cost on vacuum worlds
Light Rail	2	-50% (except tube)	No Locomotives, no AFV, Vehicle size limited to 40 Spaces

APPENDIX III

WORKSHEETS & TEMPLATES

The worksheets and templates are available to help design vehicles.

An electronic Excel worksheet for creating vehicles is available in the Downloads section of the Mongoose web site.

This section includes:

- A V**ehicle Design Worksheet**
- A **Weapon's Systems Design worksheet**
- A blank **Vehicle Display Sheet**

WEAPON SYSTEMS DESIGN

System:				**Spaces**	**Cost**
Mount:		***Side:***			
Weapon:		***Quantity:***			

	Number	***Loaders***	***Remote Gunner?***	***Autoloader?***		
Crew:						

Gun Shield?		***Armour:***			
Fire Control System:		***Other Crew:***			
			Mount Spaces:		
Modular?		***Pop-up?***			

#Crew in Mount:		**#Crew in Vehicle:**			**Ammunition Storage Spaces:**		
Range (km):		**Damage:**		**Magazine:**			
Rate of Fire:		**Traits:**			**Rounds per Space:**		

WEAPON SYSTEMS DESIGN

System:				**Spaces**	**Cost**
Mount:		***Side:***			
Weapon:		***Quantity:***			

	Number	***Loaders***	***Remote Gunner?***	***Autoloader?***		
Crew:						

Gun Shield?		***Armour:***			
Fire Control System:		***Other Crew:***			
			Mount Spaces:		
Modular?		***Pop-up?***	No		

#Crew in Mount:		**#Crew in Vehicle:**			**Ammunition Storage Spaces:**		
Range (km):		**Damage:**		**Magazine:**			
Rate of Fire:		**Traits:**			**Rounds per Space:**		

Vehicle Design Worksheet				TL:		Spaces	Cost
Vehicle Name:					Totals:		
Type:					Skill:		
Features:							
Power system(s):							
Auxiliairy Drive(s):							
Armour:	*Base:*		*Added:*				
Forward:		Aft:		Speed Modification:			
Port:		Starboard:		Range Modification:			
Dorsal		Ventral:		Hull Modification:			

Controls:			
Agility (skill level):			
Communications (range):			
Navigation (navigation DM):			
Sensors (electronics (sensors) DM):			
Camouflage (Recon) DM:			
Stealth (electronics (sensors) DM):			

Equipment	Notes	Spaces	Cost

Weapon	Range	Damage	Magazine	(Cost)	Traits	Spaces	Cost

Vehicle Display Sheet:					
Type					
Features and Traits					
TL		**Armour**			
Skill		**Forward:**		**Aft:**	
Agility		**Port:**		**Starboard:**	
Speed (cruise)		**Dorsal:**		**Ventral:**	
Range (cruise)					
Crew, Passengers					
Comfort Level	**Crew**:	**Passengers**:			
Cargo					
Hull [Structure]					
Shipping					
Cost					

Autopilot (skill level)	
Communications (range)	
Navigation (Navigation DM)	
Sensors (Electronics (sensors) DM)	
Camouflage (Recon DM)	
Stealth (Electronics (sensors) DM)	

Equipment

Weapon	**Range**	**Damage**	**Magazine**	**(Cost)**	**Traits**	**Fire control**

Vehicle Design Worksheet/Display Sheet

Description

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TRAVELLER®

VEHICLE HANDBOOK
UPDATE 2026

The universes of *Traveller* are filled with vehicles, everything from sailing ships to massive trucks to g/carriers to luxurious flying homes-from-home. The *Vehicle Handbook Update 2026* lets you build them all: submarines, drilling moles, rocket planes, grav tanks, and so much more.

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